ISSN 2564-7784
EISSN 2564-7040

Indexed in Web of Science

European Journal of Therapeutics

OFFICIAL JOURNAL OF GAZİANTEP UNIVERSITY FACULTY OF MEDICINE

Formerly Gaziantep Medical Journal

VOLUME 30 ISSUE 1 FEBRUARY 2024

eurjther.com

ISSN 2564-7784
EISSN 2564-7040

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The abbreviation should be provided in parentheses following the definition.

Authors are responsible for the accuracy of references.

References

You can download the file named "EndNote style of the Eur J Ther" on the journal web page at the link.

In references, the names of all authors should be written. Usage of "et al" should not be preferred.
If available, please always include DOIs as full DOI links in your reference list.
(e.g. "https://doi.org/.....").

Use abbreviations for journal names. Journal titles should be abbreviated in accordance with the journal abbreviations in Index Medicus/MEDLINE/PubMed.

While citing publications, preference should be given to the latest, most up-to-date publications. Authors should avoid using references that are older than ten years. The limit for the old reference usage is 15% in the journal. If an ahead-of-print publication is cited, the DOI number should be provided. Journal titles should be abbreviated in accordance with the journal abbreviations in Index Medicus/MEDLINE/PubMed. In the main text of the manuscript, references should be cited using Arabic numbers in parentheses. The reference styles for different types of publications are presented in the following examples.

Journal Article
Yurci A, Gungor ND, Gurbuz T (2021) High Endometrial Thickness Does not Affect IVF/ICSI Outcomes. Eur J Ther. 27(1):94-98. https://doi.org/10.5152/eurjther.2021.20102

Example for Journal Article without English Titles
Aktan-İkiz A, Üçerler H, Orhan M (2007) Anatomic features of fossa navicularis at the skull base and its clinical importance [Kafa iskeletinde fossa navicularis'in anatomik özellikleri ve klinik önemi]. Sendrom 19:34–36 ([In Turkish])

Epub Ahead of Print Articles
Doruk M, Mustafaoglu R, Gül H (2023) The Impact of Using Technological Devices on Mental and Physical Health in Adolescents. Eur J Ther https://doi.org/10.58600/eurjther.20232902-592.y

Book
Anderson DM (2012) Dorland's illustrated medical dictionary, 32nd edn. Saunders Elsevier, Philadelphia

Book chapter
Gray H (1858) Anatomy Descriptive and Surgical 1st edn. In: John W, Parker and Son (eds), London, pp 150-155

Online Document
Bergman RA, Afifi AK, Miyauchi R (2007) Persistent congenital arterial anastomoses. Available from http://www.anatomyatlases.org/AnatomicVariants/Cardiovascular/Images0200/0232.shtml Accessed 22 Jan 2022

Reference citations in the text should be numbered in square brackets. Some examples:

Parent et al. [3] reported that .....
..... on medical radiation [21, 22].
..... sleep quality among adolescents [15, 18-21, 22, 25-30].
..... anxiety, depression, and a decrease in proprioception [5, 16-18].

Author-Suggested Reviewers

Authors are required to propose at least five reviewers when submitting their manuscripts.
It should be noted that there should be no conflict of interest between these proposed reviewers and the authors, and that these recommendations should comply with international ethical standards.
Recommended reviewers should have competence in the subject of the article.
The proposed reviewers must not have collaborated with the authors of the article in the last three years and must not be working in the same institution.

REVISIONS

When submitting a revised version of a paper, the author must submit a detailed "Response to the reviewers" that states point by point how each issue raised by the reviewers has been covered and where it can be found (each reviewer's comment, followed by the author's reply and line numbers where the changes have been made) as well as an annotated copy of the main document. Revised manuscripts must be submitted within 30 days from the date of the decision letter. If the revised version of the manuscript is not submitted within the allocated time, the revision option may be canceled. If the submitting author(s) believe that additional time

is required, they should request this extension before the initial 30-day period is over.

Accepted manuscripts are copy-edited for grammar, punctuation, and format. Once the publication process of a manuscript is completed, it is published online on the journal's webpage as an ahead-of-print publication before it is included in its scheduled issue. A PDF proof of the accepted manuscript is sent to the corresponding author and their publication approval is requested within 2 days of their receipt of the proof.

Corrections, Retractions, and Republications

European Journal of Therapeutics follows and implements the International Committee of Medical Journal Editors (ICMJE) recommendations on Corrections, Retractions, Republications and Version Control.

Corrections, Retractions, Republications and Version Control*

Honest errors are a part of science and publishing and require publication of a correction when they are detected. Corrections are needed for errors of fact. Matters of debate are best handled as letters to the editor, as print or electronic correspondence, or as posts in a journal-sponsored online forum. Updates of previous publications (e.g., an updated systematic review or clinical guideline) are considered a new publication rather than a version of a previously published article.

If a correction is needed, journals should follow these minimum standards:

- The journal should publish a correction notice as soon as possible detailing changes from and citing the original publication; the correction should be on an electronic or numbered print page that is included in an electronic or a print Table of Contents to ensure proper indexing.
- The journal also should post a new article version with details of the changes from the original version and the date(s) on which the changes were made.
- The journal should archive all prior versions of the article. This archive can be either directly accessible to readers or can be made available to the reader on request.
- Previous electronic versions should prominently note that there are more recent versions of the article.
- The citation should be to the most recent version.

Pervasive errors can result from a coding problem or a miscalculation and may result in extensive inaccuracies throughout an article. If such errors do not change the direction or significance of the results, interpretations, and conclusions of the article, a correction should be published that follows the minimum standards noted above.

Errors serious enough to invalidate a paper's results and conclusions may require retraction. However, retraction with republication (also referred to as "replacement") can be considered in cases where honest error (e.g., a misclassification or miscalculation) leads to a major change in the direction or significance of the results, interpretations, and conclusions. If the error is judged to be unintentional, the underlying science appears valid, and the changed version of the paper survives further review and editorial scrutiny, then retraction with republication of the changed paper, with an explanation, allows full correction of the scientific literature. In such cases, it is helpful to show the extent of the changes in supplementary material or in an appendix, for complete transparency.

* Corrections, Retractions, Republications and Version Control https://www.icmje.org/recommendations/browse/publishing-and-editorial-issues/corrections-and-version-control.html Date of Access: 05.10.2023

Editor in Chief: Prof. Ayşe Balat

Address: Gaziantep Üniversitesi Tıp Fakültesi, 27310 Şehitkamil, Gaziantep, Türkiye
E-mail: info@eurjther.com

Publishing Service: Pera Publishing Services

Address: Ataköy 3-4-11 Kısım Mah. Dr Remzi Kazancıgil Cd. O-114 N:12 D:7 Bakırköy İstanbul, Türkiye
E-mail: info@perayayincilik.com
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European Journal of Therapeutics
OFFICIAL JOURNAL OF GAZİANTEP UNIVERSITY FACULTY OF MEDICINE

Contents

EDITORIAL

ORIGINAL ARTICLES

European Journal of Therapeutics
OFFICIAL JOURNAL OF GAZİANTEP UNIVERSITY FACULTY OF MEDICINE

Contents

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):e1-e2.
https://doi.org/10.58600/eurjther2063

Editorial

Happy 30th Volume and 35th Anniversary, European Journal of Therapeutics!

Ayşe Balat[1, 2], Şevki Hakan Eren[3], Mehmet Sait Menzilcioğlu[4], İlhan Bahşi[5], İlkay Doğan[6], Davut Sinan Kaplan[7], Mehmet Karadağ[8], Ayşe Aysima Özçelik[9], Fatih Sarı[10], Hamit Yıldız[11]

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Received: 2024-02-25 / **Accepted**: 2024-02-28 / **Published Online**: 2024-02-28

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Dear Colleagues,

It is an honor for us to celebrate the thirty-fifth anniversary and thirtieth volume of the establishment of the *European Journal of Therapeutics (Eur J Ther)* and to share this editorial with you.

Dr. Sabri Güngör, the first Editor-in-Chief of the *Eur J Ther (*formerly *Journal of the Faculty of Medicine, University of Gaziantep)*, said the following in 1990 [1]:

"What is happening in the medical world, which is witnessing dizzying changes every day, can be carried to the most extreme points in a very short time with today's communication tools."

"Despite our limited resources, our aim is to fulfill this function in the best possible way from the first issue onwards."

Although serious problems have been experienced from time to time during this thirty-five-year period, *Eur J Ther* has continued on its way to moving forward day by day, not counting the stagnation period between 2002 and 2006.

As the current editorial team, our goal is to carry the *Eur J Ther* further with the contributions of our esteemed colleagues.

On this 35th anniversary of the journal, we would like to thank the authors who submitted their work to *Eur J Ther*. Your valuable work has made *Eur J Ther* what it is today. We would also like to thank the hundreds of valuable referees who have served *Eur J Ther* by reviewing these

manuscripts and the previous Editors-in-Chief and Editors who have contributed to the advancement of *Eur J Ther* in scientific quality.

With our respect,

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How to Cite;

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European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):e3-e4.
https://doi.org/10.58600/eurjther2068

Editorial

30th Volume and 35th Birthday Celebration from the former Editor-in-Chief (2007-2010) of the European Journal of Therapeutics!

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Received: 2024-02-26 / **Accepted**: 2024-02-28 / **Published Online**: 2024-02-28

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Dear Colleagues,

I would like to share this editorial not as the current Editor-in-Chief of the European Journal of Therapeutics (Eur J Ther), formerly Gaziantep Medical Journal (Gaziantep Med J), but as the former Editor-in-Chief between 2007 and 2010.

It is a great pleasure and pride to celebrate the thirty-fifth anniversary of the Eur J Ther.

In 2007, when I was appointed as the Dean of Gaziantep University Faculty of Medicine, unfortunately, the journal, the last issue of which was published in 2001, was in a five-year pause. In 1990, despite limited means, the journal had started its publication life [1], and it was a significant shortcoming not to be published. This scientific spark, launched in 1990, should not have been extinguished.

Among the several projects we carried out during my tenure as a Dean, the one that made me the happiest was the resumption of the journal's publication. A dedicated team worked wholeheartedly for this journal despite many impossibilities. And, at the end of a serious process of five years, the journal was reborn from its ashes like a phoenix in 2007!

At that time, many index applications of our journal, especially the ULAKBIM TR Index, were approved. Similarly, we increased the number of issues in a year from two to three during this period [2]. In 2010, I handed over the journal's editor-in-chief with great pleasure.

Perhaps what made me the happiest in my academic career was my period as Editor-in-Chief between 2007 and 2010 and the journal's progress. It is also a source of happiness and pride that I am now contributing again as Editor-in-Chief in the thirty-fifth year of the journal.

I would like to express my gratitude to all authors, editors, referees and technical staff who have contributed to the journal in this thirty-five-year period.

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With the hope that there will be many more beautiful years to celebrate,

Yours sincerely,

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How to Cite;

Balat A (2024) 30th Volume and 35th Birthday Celebration from the former Editor-in-Chief (2007-2010) of the European Journal of Therapeutics!. Eur J Ther. 30(1):e3-e4. https://doi.org/10.58600/eurjther2068

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):e5-e6.
https://doi.org/10.58600/eurjther2064

Editorial

Letter from the Former Editor-in-Chief for 2011-2012 and 2013-2014 periods: Happy 30th volume and 35th Birthday, European Journal of Therapeutics!

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Received: 2024-02-25 / **Accepted**: 2024-02-26 / **Published Online**: 2024-02-26

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Dear Colleagues,

I am very pleased to share this editorial with you in commemoration of the 35th Anniversary and the 30th Volume of the *European Journal of Therapeutics (Eur J Ther)*, formerly *Gaziantep Medical Journal (Gaziantep Med J)*, where I served as Editor-in-Chief with great honour between 2011-2012 and 2013-2014.

The journal, which started its publication life in 1990 with the great efforts of Dr. Sabri Güngör, was initially published in two issues a year [1]. In 2009, it continued as three issues a year [2], and in 2014, during the period of our Editor-in-Chief, it started to be published as four issues a year [3]. While celebrating the thirty-fifth Anniversary and the thirtieth Volume of the journal in the February 2024 issue (Vol: 30, No: 1), I would also like to express my great happiness that it will be published six issues a year from now on.

When I was the Editor-in-Chief of the journal, there was no professional publisher support. We had not received any financial support during that time. So, we had to work hard to publish the issues on time. We managed to publish issues in both online and print versions. We used our university's printing office. I must indicate that I am very grateful to the director and workers of the printing office for their enormous help in publishing the printed issues of the journal at that time. As the Editor-in-Chief of the journal, I compiled all the previously published issues, converted them into PDF files, and formed the archives of the journal. We made the first attempt to increase the number of editorial board members by including foreign editors. It was one of the steps to becoming an international journal. We started to accept articles written in English. After all this work, we applied for indexing the journal with different organizations, and we received positive returns.

I believe that the former, current, and future editors are fighting in a long-term relay race as players of the same team. As one of the former Editor-in-Chiefs, I would like to express that I will always provide all the support I can for the further development of the journal, and I would like to thank all the editors who have contributed to the further development of the journal through this editorial.

Yours sincerely,

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European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):e7.
https://doi.org/10.58600/eurjther2072

Editorial

Letter from the Former Editor-in-Chief, Hasan Bayram, MD, PhD: Happy 30th volume and 35th year of the European Journal of Therapeutics!

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Received: 2024-02-29 / **Accepted**: 2024-02-29 / **Published Online**: 2024-02-29

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Dear Colleagues,

I have been very happy to see that our journal, the European Journal of Therapeutics, has reached its 35th year by publishing 78 issues over the years. Many congratulations!

I would like to sincerely thank the Editors and publishing team for their great dedication and efforts in helping the Journal reach this stage, and more importantly, the authors who supported the Journal with their scientific work and manuscripts.

I had the opportunity to contribute to our Journal, as Editor-in-Chief between 2014 and 2016 with great honor [1]. The preparation of issues, the editing and printing of the manuscripts were being carried out with limited resources within the Medical Faculty and Gaziantep University, and there were disruptions from time to time. However, in order for the Journal to reach the place it deserves in the publishing world, the issues had to be prepared on time, the peer review process had to be carried out meticulously, and the printing quality had to be improved. At that time, with the support of the Dean of the Faculty of Medicine, for the first time, a contract was signed with a professional publisher and an attempt was made to maintain a more uninterrupted and professional publication process. I have been very happy to see that this effort has continued with increasing momentum in the period after the period I served for the Journal. I am happy to follow the Journal closely and contribute by reviewing the articles sent from time to time. I sincerely hope that our journal will rise to the top in the publishing world for many years to come.

Yours sincerely,

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How to Cite;

Bayram H (2024) Letter from the Former Editor-in-Chief, Hasan Bayram, MD, PhD: Happy 30th volume and 35th year of the European Journal of Therapeutics!. Eur J Ther. 30(1):e7. https://doi.org/10.58600/eurjther2072

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European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):1-11.
https://doi.org/10.58600/eurjther1921

Original Research

Fear of Childbirth and Breastfeeding Self-Efficacy and Predictors of Breastfeeding Self-Efficacy in Pregnant Women

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Received: 2023-11-07 **Accepted:** 2024-01-30 **Published Online:** 2024-01-30

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This study was presented in the 2nd International 4th National Birth Preparation Education and Training Congress held in Izmir in October 2022.

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ABSTRACT

Objective: The purpose of this study was to determine the relationship between the fear of childbirth (FOC) and prenatal breastfeeding self-efficacy, the factors affecting them, and the factors that predict breastfeeding self-efficacy among Turkish pregnant women.

Methods: The research was a descriptive and cross-sectional type. The study was conducted with 228 pregnant women who came to the obstetrics outpatients' department at 28-40 weeks of gestation**.** Data were collected using an Individual Description Form, the Wijma Delivery Expectancy/ Experience Scale (W-DEQ), and the Prenatal Breastfeeding Self-Efficacy Scale (PBSES).

Results: The mean age of the pregnant women was 28.09±4.29. The W-DEQ scores of the pregnant women were 66.50±11.38, and their PBSES scores were 63.71±4.43. More than half of the pregnant women (59.1%) experienced severe and clinical FOC. Prenatal breastfeeding self-efficacy was significantly lower in pregnant women with severe and clinical FOC compared with those with mild and moderate FOC ($p<0.001$). There was a very low level negative correlation between FOC and PBSES ($r= -0.277$, $p<0.001$). W-DEQ, education level, duration of marriage, feeling about pregnancy and duration of breastfeeding were determined as predictors of PBSES ($p<0.05$, R^2:0.472).

Conclusion: It was found that the majority of pregnant women experienced levels of severe and clinical FOC and their prenatal breastfeeding self-efficacy perceptions were moderate. Health professionals should provide education and counseling to pregnant women to reduce the fear of childbirth experienced by pregnant women and to improve their prenatal breastfeeding self-efficacy. In this way, mother-child health will be protected both during pregnancy and in the postnatal period.

Keywords: Fear of childbirth, fear, pregnant women, breastfeeding, breastfeeding self-efficacy.

INTRODUCTION

Birth is a time in motherhood when physical, psychological, and social changes take place [1]. Women have both positive and negative expectations and experiences of pregnancy and birth. This is because pregnancy and birth include many factors such as happiness, pain, expectations, and experiences. Pregnant women may experience fear of birth for such reasons as being in an unfamiliar environment, not being able to protect their privacy, or not being able to manage the birth process [1, 2]. Fear of childbirth (FOC) has been defined as anxieties about birth which upset a pregnant woman's daily life and health [3]. Fear of childbirth is a complex and multi-directional problem relating to a pregnant woman's specific birth experiences and expectations [1, 4]. Determining the factors relating to FOC and

at-risk pregnant women is important for establishing suitable interventions. Increased fear relating to birth may cause such problems as an increase in the severity of pain, a lengthening of the birth process, and the use of anesthesia [3, 5]. It has been reported that not receiving education and counseling before giving birth and having negative perceptions and experiences regarding birth increase the FOC [6, 7]. It has been reported in studies that 20.8-86% of pregnant women [6, 8-10], and in Türkiye 47-70.4%, experience FOC of varying severity and clinical levels [4, 11]. FOC can reach a mild clinical level and can cause an extension of the birth process [5, 10].

Breastfeeding self-efficacy is a woman's thoughts on breastfeeding, whether or not to choose to breastfeed, the emotional and psychosocial difficulties experienced, and the skill of coping with these difficulties [12-15]. Pregnancy is a time when many physiological, psychological, and social changes are experienced. One of the topics that it is important to pay attention to during pregnancy is breastfeeding. The period of pregnancy is important for most women's breastfeeding because they decide the time before birth and how they will feed their babies [7, 16]. Breastfeeding is more preferred by women with high self-efficacy [14-16]. Pregnant women's self-efficacy regarding breastfeeding affects the suckling process. Women with high breastfeeding self-efficacy show a more positive attitude to problems that they encounter with breastfeeding [15, 17, 18]. It has been reported in studies that when the Prenatal Breastfeeding Self-Efficacy Scale (PBSES) was applied to pregnant women, they had a prenatal breastfeeding self-efficacy at a medium or high level of 70-112 [15, 19, 20-23], and it is reported that pregnant women in Türkiye generally have prenatal breastfeeding self-efficacy at a medium level [18, 19, 24]. It has been reported that women's breastfeeding self-efficacy is higher in women with a high education or income level and increasing age, and in those with a greater number of children. It can therefore be said that a country's sociocultural and economic differences affect women's prenatal breastfeeding self-efficacy [15, 18, 19, 23, 25]. Low breastfeeding self-efficacy can cause women to leave breastfeeding early and shorten the period of breastfeeding, and can hurt breastfeeding success and the breastfeeding process [15, 17, 18, 26]. Breastfeeding is the perfect way of strengthening the bond between mother and baby, and of providing the baby with mother's milk, for which there is no alternative [27]. For this reason, pregnant women's breastfeeding self-efficacy is important and should be evaluated.

Main Points:

- Fear of childbirth affects more than half of pregnancies in Türkiye and only 41% of women breastfeed in the first six months postpartum. Poor fear of childbirth control leads to poor prenatal and postnatal breastfeeding self-efficacy, and to poor maternal and neonatal outcomes.
- Our study provides basic recommendations regarding prenatal management of women with fear of childbirth, its effect on prenatal breastfeeding self-efficacy, and the factors that predict prenatal breastfeeding self-efficacy. The study contributes to increasing the awareness of healthcare providers about fear of childbirth and prenatal breastfeeding self-efficacy and influencing factors.

The emotional and psychological changes experienced during the birth process also affect prenatal breastfeeding self-efficacy. Studies have reported that women who have experienced anxiety and depression during pregnancy leave breastfeeding early and that it reduces their will to breastfeed [28-30]. FOC is also a significant emotional symptom experienced in pregnancy and is an important factor affecting coping with difficulties [31, 32]. Thus, there is a possibility of a fall in the breastfeeding self-efficacy of pregnant women who have an FOC, a reduction in their willingness to breastfeed and a reduction in the length of time they breastfeed. In this regard, determining FOC and breastfeeding self-efficacy during pregnancy and establishing the predictors affecting breastfeeding self-efficacy will allow the identification of pregnant women with a high FOC or who are at risk regarding starting to breastfeed or leaving off early, and allow health care providers to perform more holistic care and interventions with pregnant women. Also, healthcare providers (especially nurses and midwives) will be able to allow pregnant women with an FOC to have more positive birth experiences, to be more willing to breastfeed, and to extend the period of breastfeeding in light of this information. Healthcare providers (especially nurses and midwives) will be able to give education and counselling to pregnant women, to raise their breastfeeding self-efficacy, and reduce their fear of birth. This will contribute to mother and child health.

We aimed to determine the relationship between the fear of childbirth and prenatal breastfeeding self-efficacy, the factors affecting them, and the factors that predict breastfeeding self-efficacy among Turkish pregnant women.

MATERIALS AND METHODS

A descriptive and cross-sectional study was conducted with pregnant women at 28-40 weeks of gestation who came for routine control to the obstetrics outpatients' department of a training and research hospital in İzmir in western Türkiye between July and September 2022. The population of the study consisted of 1032 pregnant women who came to the obstetrics outpatients' department for routine control between January and December 2021. A total of 284 pregnant women were invited to participate in this study. Among the pregnant women, seven had multiple pregnancies, eight had their babies transferred to another hospital, five had a diagnosis of psychiatric illness in the previous six months, 11 had a communication barrier, eight were illiterate, five left the answers to the questions incomplete, and 12 were not included in the study because they did not agree to participate voluntarily.

The sample of the study finally consisted of 228 pregnant women (80.3%) who came to the obstetrics outpatients' department for routine control, were in the 28-40th gestational week, had a single healthy fetus, did not have a risky pregnancy, had no condition that prevented breastfeeding, did not have a diagnosis of psychiatric disease, spoke Turkish, were literate and volunteered to participate in the study between July and September 2022. A simple random sampling method was used for the pregnant women.

The power of the study was calculated using the program G.Power-3.1.9.2. At the end of the study, post-hoc power analyses showed that with an effect size of 0.80, a 95% confidence interval and 5% error for the multiple linear regression analyses, results showed that 228 pregnant women were sufficient to complete the study, and the power of the study calculated as post-hoc was calculated as 1.00 [33].

The data of the study were collected using an Individual Description Form, the Wijma Delivery Expectancy/Experience Scale (W-DEQ) version A, and the Prenatal Breastfeeding Self-Efficacy Scale (PBSES). All forms were given by face-to-face interview and filled out by the patients. The completion of forms took approximately 20 minutes. The Individual Description Form was prepared by the researchers based on previous studies [8, 10, 15, 17, 20, 24]. The form consisted of 16 questions about the socio-demographic, obstetric, and breastfeeding characteristics of the pregnant women.

The Wijma Delivery Expectancy/Experience Scale (W-DEQ version A) was developed by Wijma, Wijma, and Zar [34] in 1998 to measure the fear of childbirth (FOC) experienced by pregnant women. The scale consists of 33 items. The scale is of a six-way Likert type. Scores on the scale range between 0 and 165. A high total score indicates a high level of FOC. A score of ≤37 indicates mild FOC, 38-65 indicates moderate FOC, 66-84 indicates severe FOC, and ≥85 indicates clinical FOC [34]. The Turkish validity and reliability of the scale were tested by Körükcü, Kukulu, and Firat [35] in 2012. The Cronbach alpha value of the scale was 0.89. In this study, the Cronbach alpha value of the scale was 0.81.

The Prenatal Breastfeeding Self-Efficacy Scale (PBSES) was developed by Wells, Thompson, and Kloeblen-Tarver [21] in 2006 to determine the breastfeeding self-efficacy perceptions of pregnant women. The scale consists of 20 items, and is a five-way Likert type scale. Scores range from 20 to 100, the highest perceived self-efficacy. The scale has four subgroups. These are skills and demands required for breastfeeding (8 items), gathering information about how to breastfeed (5 items), breastfeeding around other people and feelings of embarrassment during breastfeeding (4 items), and social pressure when breastfeeding (3 items). The Cronbach alpha value of the scale was found to be 0.89 [21]. The Turkish validity and reliability of the scale was tested by Aydın and Pasinlioğlu [20] in 2018. The Cronbach alpha value of the scale was 0.85. In this study, the Cronbach alpha value of the scale was 0.79.

After obtaining ethical approval from the university and the study hospital, the first researcher contacted the relevant nursing and midwifery departments at the hospital, asking for to support in this study. The researchers interviewed pregnant women who came to the obstetrics outpatients' department of a training and research hospital for routine control. Before handing out the forms, the researchers gave explanations about the purpose of the study, the benefits to be obtained from the research and the time they would spend for the interview, and obtained verbal and written consent from the pregnant women. Informed consent was obtained from all of the women included in the study. After signing the consent forms, the pregnant women who were recruited filled out the individual description form, the Turkish version of W-DEQ and the PBSES. Filling out the forms took approximately 20 minutes. Researchers were available to explain the pregnant women's questions. All forms were given by face-to-face interview and filled out by the pregnant women.

Before the study was conducted, ethical approval was obtained from Izmir Katip Çelebi University Non-Interventional Clinical Research Ethics Committee (Decision No: 0267, Date: 26.05.2022) and permission was obtained from the hospital where the study was conducted (Decision No: 2022/72, Date: 07.07.2022). The women were informed about the research, and their verbal and written informed consent was obtained. The research was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis

The analysis of the data obtained from the research was carried out in the SPSS 25.0 statistical program package. The conformity of the data to normal distribution was evaluated using the kurtosis and skewness values and the Kolmogorov-Smirnov test. Categorical variables were presented as numbers (n) and percentages (%), and continuous variables were described using means and standard deviations (SD) (min-max). The difference between the groups according to the scale scores was examined with a t-test (two groups) and the One-Way ANOVA test (three or more groups). Pearson correlation analysis was used to show the relationship between W-DEQ and PBSES. A multiple linear regression model was established to evaluate the effect of independent variables on the PBSES score. In addition, Multiple Linear Regression Analysis was performed to determine the predictors of PBSES. To calculate the effect size coefficient of determinations in the linear models, we employed R^2 (Coefficient of determination). The results were evaluated at the 95% confidence interval and the significance level of $p<0.05$.

RESULTS

The socio-demographic, obstetric, and breastfeeding characteristics of the pregnant women are shown in Table 1. The mean age of the total of 228 pregnant women included in this study was 28.09±4.29 years, and the mean of their gestational weeks was 32.48±2.22 weeks. A majority of the women had a low educational level (71.1%), 65.4% were nonworking, 84.6% were living in a nuclear family, 76.8% had a low income, and 69.3% were multiparous.

Women with a lower level of education (p=0.004), and their partners (p<0.001), those with a low level of income (p=0.041), those who were primiparous (p=0.003) or had not given birth before (p=0.009), those with no breastfeeding experience (p=0.007), and mothers with 0-6 months of previous breastfeeding experience (p=0.007) had a significantly higher FOC (Table 1). Women with a lower level of education (p<0.001), and their partners (p<0.001), those who lived in an extended family (p = 0.010), those in the first ten years of marriage (p<0.001), those who felt uncertain about pregnancy (p=0.008), those for whom the baby's gender didn't matter and those who wanted a baby girl (p<0.001), and those who had not given birth before (p=0.043) had a significantly lower PBSES score (Table 1).

Table 1. Comparison of socio-demographic, obstetrics and breastfeeding characteristics according to W-DEQ and PBSES scores

			W-DEQ		PBSES	
	Mean±SD		r	p	r	p
Age	28.09±4.29		0.023	0.733	0.004	0.955
Gestational week	32.48±2.22		-0.123	0.064	0.010	0.887
	n	%	Mean±SD	Test-p	Mean±SD	Test-p
Education						
Under high school	162	71.1	67.93±10.92	t=2.944	62.98 ±4.34	t=4.079
High school and above	66	28.9	62.96±11.81	**p=0.004**	65.50±4.16	**p<0.001**
Partner' Education						
Under high school	102	44.7	69.15±9.48	t=3.325	62.33 ±4.32	t=-4.392
High school and above	126	55.3	64.34±12.34	**p<0.001**	64.83±4.21	**p<0.001**
Work						
Working	79	34.6	66.79±11.98	t=0.280	63.91 ±3.19	t=0.553
Not working	149	65.4	66.34±11.09	p=0.780	63.61±4.96	p=0.581

Family type						
Nuclear	193	84.6	66.58±11.53	t=0.263	64.08 ±4.23	t=2.685
Extended	35	15.4	66.05±10.67	p=0.793	61.68±4.96	**p=0.010**
Income						
Low	175	76.8	67.40±10.98	t=2.075	63.59±4.56	t=-0.801
Middle	53	23.2	63.50±12.25	**p=0.041**	64.11±3.99	p=0.425
Marriage duration (year)						
1-5	126	55.3	66.01±9.01	F=0.262	63.27±3.81	F=6.787
6-10	86	37.7	67.12±13.48	p=0.770	63.65±5.08	**p<0.001**
11 and above	16	7.0	67.00±15.79		67.50±3.51	
Pregnancy						
Primiparous	70	30.7	69.11±5.76	t=3.039	63.41±3.93	t=-0.725
Multiparous	158	69.3	65.34±12.97	**p=0.003**	63.84±4.63	p=0.469
Planning pregnancy						
Yes	170	74.6	66.91±10.98	t=0.877	64.56±4.66	t=-1.644
No	58	25.4	65.29±12.51	p=0.383	63.42±4.32	p=0.104
Do want pregnancy						
Yes	196	86.0	66.52±11.45	t=0.068	63.68 ±4.47	t=-0.229
No	32	14.0	66.37±11.09	p=0.946	63.87±4.22	p=0.820
Feeling about pregnancy						
Positive	165	72.4	66.40±10.08	t=-0.184	64.15±4.59	t=2.696
Uncertain	63	27.6	66.76±14.34	p=0.855	62.55±3.76	**p=0.008**
Desired gender						
Girl	47	20.6	63.63±10.12	F=1.921	65.14±4.27	F=8.705
Boy	23	10.1	66.65±12.82	p=0.149	66.08±4.50	**p<0.001**
It does not matter	158	69.3	67.32±11.45		62.94±4.26	
Desired mode of birth						
Vaginal	112	49.1	67.38±10.24	t=1.157	63.86±4.53	t=0.505
Cesarean section	116	50.9	65.64±12.37	p=0.249	63.56±4.34	p=0.614
Breastfeeding experience						
Yes	131	57.5	64.90±13.81	t=-2.737	64.19±4.55	t=1.950
No	97	42.5	68.64±6.31	**p=0.007**	63.06±4.19	p=0.052
Breastfeeding durationa*						
0-6 months	53	40.5	68.88±10.43	F=5.195	62.77±4.10	F=8.322
7-12 months	62	47.3	61.32±16.52	**p=0.007**	63.62±3.24	**p<0.001**
13-24 months	16	12.2	61.37±11.87		66.03±4.80	

W-DEQ: Wijma Delivery Expectancy/Experience Questionnaire. PBSES: Prenatal Breast-Feeding Self-Efficacy Scale. SD: Standard deviation. r: Pearson correlation test. t: Independent two sample 't' test. F: One-Way Anova Test *Calculated over: n=131

In the study, the W-DEQ score was 66.50±11.38 and the PBSES score was 63.71±4.43. PBSES sub-dimension scores are given in Table 2. The criterion for severe to clinical level FOC was fulfilled by 59.1% (n=135). Prenatal breastfeeding self-efficacy is compared according to the levels of FOC in Table 3. There was a low but significant level of negative correlation between FOC and gathering information about how to breastfeed (r=-0.419; p<0.001). FOC showed a very low-level but significant negative correlation between both breastfeeding in the presence of other people and feeling embarrassed during breastfeeding (r=-0.278; p=0.042) and the PBSES total score (r=-0.277; p<0.001) (Table 3).

Finally, a multiple linear regression analysis was used to detect any variation independently related to PBSES scores (Table 4). The best-fit regression model revealed five variables that explained 47% of the variance in PBSES scores in the antenatal periods. Maternal characteristics predicting breastfeeding self-efficacy included W-DEQ, education level, marriage duration, feelings about pregnancy, and breastfeeding duration (p<0.05, R^2:0.472).

Table 2. W-DEQ and PBSES sub-dimension and total scores

Scales	Mean±SD	Min-Max
W-DEQ	66.50±11.38	36-87
PBSES	63.71±4.43	50-75
PBSES sub-dimension		
Skills and demands required for breastfeeding	24.34±2.52	18-30
Gathering information about how to breastfeed	15.50±1.71	10-20
Breastfeeding around other people and feelings of embarrassment during breastfeeding	12.74±2.22	8-17
Social pressure when breastfeeding	11.12±1.50	8-14

W-DEQ: Wijma Delivery Expectancy/Experience Questionnaire. PBSES: Prenatal Breast-Feeding Self-Efficacy Scale. SD: Standard deviation

Table 3. The relationship between the W-DEQ, the levels of FOC and the PBSES sub-dimension and total scores

FOC			Skills and demands required for breastfeeding	Gathering information about how to breastfeed	Breastfeeding around other people and feelings of embarrassment during breastfeeding	Social pressure when breastfeeding	PBSES
	n	%	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Mild to moderate level ≤65*	93	40.8	24.20±2.68	16.24±1.57	13.08±1.88	11.34±1.41	64.88±4.32
Severe to clinical level ≥ 66	135	59.2	24.44±2.41	14.98±1.62	12.51±2.41	10.97±1.54	62.91±4.34
Test-p			t=-0.692 p=0.490	t=5.869 **p<0.001**	t=2.042 **p=0.042**	t=1.852 p=0.065	t=3.377 **p<0.001**
W-DEQ	**r** **p**		0.117 0.077	**-0.419** **p<0.001**	**-0.278** **p<0.001**	-0.104 0.118	**-0.277** **p<0.001**

FOC: Fear of childbirth. W-DEQ: Wijma Delivery Expectancy/Experience Questionnaire. PBSES: Prenatal Breast-Feeding Self-Efficacy Scale SD: Standard deviation; t: Independent two sample 't' test. r: Pearson correlation test.

*Two people at mild level were added to the moderate level and seven people in the clinical level were added to the severe level.

Table 4. Regression analysis of the effect of socio-demeographic, obstetric and breastfeeding characteristics on PBSES scores

Independent Variables	B	Standart Error	β	t	CI 95%		R	R^2	Adjusted R^2	p
Constant	70.517	1.996	-	35.335	66.549	74.486	0.687	0.472	0.441	0.000
W-DEQ	-0.100	0.028	-0.301	-3.532	-0.156	0.044				0.001
Education (High school and above)	1.847	0.996	0.163	1.855	-0.133	3.827				0.067
Marriage duration (11 and above year)	3.207	1.092	0.255	2.937	1.035	5.378				0.004
Feeling about pregnancy (Uncertain)	-2.743	0.804	-0.286	-3.412	-4.343	-1.144				0.001
Breastfeeding duration (0-6 months)	2.614	0.804	0.267	3.253	1.016	4.212				0.002

B:Unstandardized Coefficient. β:Standardized Coefficient. CI: Confidence Interval. W-DEQ: Wijma Delivery Expectancy/Experience Questionnaire. R^2: Coefficient of determination. Backward selected. Excluded Variables: Partner' education, family type, desired gender.

DISCUSSION

More than half of the pregnant women in the study (59.1%) experienced FOC at a serious clinical level. In a study by Nieminen et al. [8], 86% of pregnant women, and in a study by Barut and Uçar [4] 70.4%, experienced FOC at a higher, more serious clinical level. Serious clinical level FOC was experienced at a lower level by 20.8% of pregnant women in a study by Salomonsson et al. [9], 47% in a study by Bülbül et al. [11], and by 42.6% in a study by Dereje et al. [6]. In the present study, the total W-DEQ score was 66.50±11.38, but it was higher (125±18.2) in the study by Nieminen et al. [8]. In the study by Salomonsson et al. [9] it was higher at 68.5±22.4 and in the study by Bülbül et al. [11] it was lower, at 48.7±19.3. It is thought that this difference is related to cultural factors, the geographical area where studies were carried out, the women's number of pregnancies, and their view of the act of birth. Also, in the present study, the W-DEQ score of primiparous women was significantly higher than that of multiparous women. A study by Toohill et al. [10] in Australia was similar to ours. Primiparous women are about to experience birth for the first time, and this fear of the unknown regarding birth together with what they have heard in the past may have increased their FOC. In the present study, the education level of both the pregnant woman and her partner significantly increased FOC. In addition, in this study, FOC in pregnant women with a low income level was significantly higher. Hildingsson et al. [3] and Salononsson et al. [9] reported, similar to the present study, that pregnant women with a low level of education had a greater FOC. It may be said that the reason for this is that a low income increases economic anxieties and stress and thus the fear relating to birth.

Fear of childbirth was significantly higher in women who had not previously given birth, those who had not experienced breastfeeding, and those who breastfed for only the first six months (Table 1). The fact that women who have given birth and experienced breastfeeding have more knowledge and experience about the prenatal period may have caused them to view birth more positively and have a lower FOC.

Determination of breastfeeding self-efficacy among Turkish women during pregnancy and its predictors helps to establish low breastfeeding self-efficacy at an early stage and in the postpartum period, and to identify mothers who are at risk of leaving off breastfeeding early or not breastfeeding. Determining breastfeeding self-efficacy during pregnancy will allow healthcare providers to perform more comprehensive interventions with pregnant women, and make mothers more willing to breastfeed their babies. In this study, the total PBSES score of Turkish pregnant women was 63.71±4.43, which is lower than what is reported in other studies conducted in Türkiye [18, 19, 24]. Total PBSES scores were 72.32±13.36 in pregnant women in Spain [23], 112.83±20.19 in China [15], and 70±11.9 in Arabia [22]. Pregnant women's breastfeeding self-efficacy was found to be lower in the present study than in other studies. Breastfeeding self-efficacy shows whether a mother will breastfeed, how much effort she will put into breastfeeding, her thoughts on breastfeeding, and her skill at coping with the difficulties she will face in the breastfeeding process [13-15]. The differences in PBSES scores may derive from receiving inadequate information on breastfeeding in antenatal classes and during pregnancy, and from the pregnant women not being ready for the breastfeeding process. We also think that the communities where the studies were conducted and the beliefs and values of pregnant women regarding breastfeeding affect prenatal breastfeeding self-efficacy.

Further, breastfeeding self-efficacy may be related to difficulties experienced in different situations during pregnancy. One of these is the fear of childbirth experienced by pregnant women. In the present study, FOC was determined as an important predictor of pregnant women's breastfeeding self-efficacy. An increase of one unit of FOC experienced by the pregnant women reduced their PBSES scores by 0.1 units (B=-0.100). Moreover, in this study, there was a significant but very low-level negative relationship between the breastfeeding self-efficacy and the FOC of pregnant women (r=-0.277). More than half of the women (59.1%) experienced FOC at a serious clinical level. Comparing pregnant women experiencing FOC at a serious clinical level with those experiencing it at a mild or medium level, it is seen that their breastfeeding self-efficacy was significantly lower. Fear is an important factor affecting coping with difficulties. It reduces an individual's capacity to fight and produce effective solutions and causes a feeling of hopelessness [31, 32]. Thus, breastfeeding self-efficacy may be reduced in a pregnant woman who has an FOC, the process of breastfeeding may be negatively affected, and the breastfeeding duration may be shortened. This is because breastfeeding self-efficacy is an important factor affecting the results and continuation of breastfeeding [15-18, 26]. There are studies on the effect of emotional problems such as stress and anxiety on the breastfeeding process. Shao et al. [29] reported that women experiencing pregnancy-related anxiety had a higher risk of leaving off breastfeeding in the first

six months and that their duration of breastfeeding was shorter. Ystrom [30] reported that anxiety and depression levels were related to ceasing breastfeeding. Fairlie et al. [28] stated that high anxiety and depression levels lowered the probability of planning breastfeeding. Eker and Aydın Beşen [25] reported a significant correlation between FOC and PBSES scores.

It was determined in the present study that education level was a predictor of breastfeeding self-efficacy in pregnant women. An education level of high school and above increased PBSES scores by 1.85 units (B=1.847). In a study by Aygor et al. [24], education levels of high school and above increased breastfeeding self-efficacy by 5.47 units. Studies by Konukoğlu and Pasinlioğlu [19] and Eker and Aydın Beşen [25] were similar to our study. Dennis [14] reported it in a study that mothers with a high level of education had higher breastfeeding self-efficacy than mothers with a low level of education. It may be said that as education level increased, pregnant women's levels of awareness of breastfeeding and their efforts to access more information on breastfeeding increased, which also increased their breastfeeding self-efficacy.

Another predictive factor of pregnant women's breastfeeding self-efficacy was years of marriage. A one-unit increase in years of marriage increased PBSES scores by 3.21 units (B=3.207). As the years of marriage increased, the women's experience of breastfeeding also increased. A majority of the women in our study were multiparous (89.3%), and had experience of breastfeeding (57.5%). It has been reported in the literature that women with previous experience of breastfeeding have higher breastfeeding self-efficacy [15, 18]. It was also found in the present study that 57.5% of pregnant women with experience of breastfeeding had higher breastfeeding self-efficacy, but the difference was not significant. It is predicted that an increase in the duration of marriage will increase the probability of breastfeeding experience. Therefore, it is thought that an increase in the duration of marriage will increase prenatal breastfeeding self-efficacy.

In this study, another predictor of breastfeeding self-efficacy was the women's feelings about pregnancy. The PBSES scores of those with feelings of uncertainty about pregnancy were 2.74 points lower than the scores of those with positive feelings about pregnancy (B=-2.743). Uncertainties about pregnancy and negative thoughts lower women's prenatal breastfeeding self-efficacy. In this study, the PBSES scores of those with positive thoughts about pregnancy were significantly higher. In another study, a significant positive correlation was found between acceptance of pregnancy and PBSES scores [25]. Positive thoughts about pregnancy and taking to pregnancy made women more willing on the subject of breastfeeding.

In our study, another factor predicting breastfeeding self-efficacy was the duration of breastfeeding (0-6 months). A one-unit increase in breastfeeding duration increased PBSES scores by 2.61 units (B=2.614). Women with previous experience of breastfeeding may look more positively on breastfeeding again, may cope better with difficulties relating to breastfeeding, and may have a higher breastfeeding self-efficacy. Also, breastfeeding strengthens the bond between mother and baby [27, 36]. For this reason, it may be said that as the duration of breastfeeding increases, breastfeeding self-efficacy also increases.

Limitations

Our research has some limitations. First, the study sample consisted of pregnant women who came to the obstetrics outpatients' department over a period of only three months. A second limitation is that the sample of the research is limited to one hospital. Also, the form and scales used were filled in based on self-reporting.

CONCLUSION

In conclusion, this study sheds light on the significant challenges faced by pregnant women, particularly the prevalence of a high level of fear of childbirth among more than half of the participants, with prenatal breastfeeding self-efficacy remaining at a moderate level. Our research has identified key predictors of prenatal breastfeeding self-efficacy, including the W-DEQ score, education level, marriage duration, feelings about pregnancy, and breastfeeding duration, which collectively account for 47% of the variance. These findings underscore the critical importance of addressing FOC and breastfeeding self-efficacy in maternal healthcare. Healthcare providers, especially nurses and midwives, play a pivotal role in supporting pregnant women throughout their journey, from the earliest stages of pregnancy to the postpartum period.

To enhance the well-being of expectant mothers and infants, we recommend several key actions. Firstly, healthcare providers, including nurses and midwives, should proactively monitor and respond to psychological changes experienced by pregnant women, collaborating with multidisciplinary teams when

necessary. Secondly, healthcare providers need to possess a deep understanding of the psychological changes and factors influencing prenatal breastfeeding self-efficacy, enabling them to identify at-risk pregnant women and provide tailored training and counseling. To achieve this, comprehensive training programs for healthcare professionals in these areas are essential. Lastly, healthcare providers should continue their support beyond pregnancy into the postpartum period, offering breastfeeding guidance and psychological support to promote the overall health and well-being of both mothers and their newborns.

This study was presented in the 2nd International 4th National Birth Preparation Education and Training Congress held in Izmir in October 2022.

Acknowledgments: We thank all pregnant women participated in this study.

Conflict of interest: The authors declare no conflict of interest.

Funding: **:** Authors declared no financial support.

Informed Consent: The women were informed about the research (informed consent), and their verbal and written consent was obtained. The research was conducted in accordance with the Principles of the Declaration of Helsinki.

Ethical Approval: Ethical approval was obtained from Izmir Katip Çelebi University Non-Interventional Clinical Research Ethics Committee (Decision No: 0267, Date: 26.05.2022) and permission from the hospital where the study was conducted (Decision No: 2022/72, Date: 07.07.2022). The study protocol was approved by the institutional review board of the Izmir Provincial Health Directorate. Permission was obtained from the researchers who conducted the Turkish validity and reliability of the scales used in the study. The purpose, nature, confidentiality, anonymity and right of women to refuse to participate in the study were explained to the participants. Written and verbal consent was obtained from woman who voluntarily agreed to participate in the study and met the inclusion criteria. Informed consent was obtained from all pregnant woman included in the study. The research was conducted in accordance with the Principles of the Declaration of Helsinki.

Author Contributions: Conception: E, D, T, Ö; M, K - Design: E, D, T, Ö; M, K - Supervision: E, D, T, Ö - Fundings: E, D, T, Ö; M, K -Materials: E, D, T, Ö; M, K - Data Collection and/or Processing: E, D, T, Ö; M, K - Analysis and/or Interpretation: E, D, T, Ö- Literature: E, D, T, Ö; M, K - Review: E, D, T, Ö; M, K - Writing: E, D, T, Ö; M, K - Critical Review: E, D, T, Ö; M, K.

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How to Cite;

Topaloğlu Ören ED, Kahveci M (2024) Fear of Childbirth and Breastfeeding Self-Efficacy and Predictors of Breastfeeding Self-Efficacy in Pregnant Women. Eur J Ther. 30(1):1-11. https://doi.org/10.58600/eurjther1921

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):12-20.
https://doi.org/10.58600/eurjther1967

Original Research

Assessing the Quality and Reliability of Rheumatoid Arthritis Exercise Videos on TikTok and YouTube

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Received: 2023-12-19 **Accepted**: 2024-01-29 **Published Online**: 2024-01-29

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ABSTRACT

Objective: An autoimmune condition that frequently affects the synovial joints and other organ systems is called rheumatoid arthritis (RA). Social media platforms are increasingly used to access health-related information. The purpose of this study is to evaluate the RA exercise videos on YouTube and TikTok in terms of their accuracy, quality, and content-specificity.

Methods: The term "rheumatoid arthritis exercise" was sorted on YouTube and TikTok on 25 July 2023. To simulate an average search query, the keyword by "top" results on TikTok and by "relevance" on YouTube were used. The Journal of American Medical Association (JAMA), DISCERN, and Global Quality Scale (GQS) scoring systems were used to evaluate the information's quality and accuracy. Additionally, the videos' attributes and sources were examined.

Results: Fifty videos from each platform were included out of the 186 videos that were evaluated. YouTube videos had more views (35438 vs. 5989, $p<0.001$), likes (871 vs. 199, $p<0.001$), and uploads by doctors (34% vs.14%, $p<0.001$) in addition to being longer (12.12 minutes vs. 0.42 minutes, $p<0.001$). YouTube videos were also significantly more likely to receive high DISCERN reliability, quality and overall scores (21,5(11) vs. 15(6), 15(9) vs. 9(4) and 40,5(21) vs. 28(9), $p<0.001$, respectively). In addition, YouTube videos had higher GQS scores and JAMA scores (24% vs. 4%, 2(1) vs. 1(1), $p<0.001$, respectively).

Conclusion: RA exercise related videos are more likely to have higher quality and accuracy on YouTube than on TikTok. It is important to provide videos by healthcare professionals to guide patients about accurate and high-quality health-related information.

Keywords: Rheumatoid arthritis, exercise, social media platforms, YouTube, TikTok

INTRODUCTION

One of the most common autoimmune diseases, rheumatoid arthritis (RA) primarily affects the synovial joints along with several other organ and tissue systems, such as the heart, lungs, and blood vessels [1]. The general population's prevalence ranges from 0.5% to 2% [2]. The pathogenesis of disease are complex and chronic inflammatory process leads to joints destruction as well as extra-articular involvement [3]. Numerous pharmacological and non-pharmacological treatment approaches for RA patients have advanced dramatically in

terms of their ability to lower inflammation, relieve symptoms, or impede the course of the illness [4]. For the safe and effective treatment of chronic inflammatory joint diseases like RA, exercise therapy is essential [5]. Previous studies have demonstrated that specifically designed exercise programmes such as aerobic exercises and muscle strength trainings improve physical functions, cardiorespiratory capacity, pain and have an improvement in RA patients' cognitive status [5,6].

Patients and healthcare professionals are using the internet and social media more and more to access online health information. Many patients use various social media platforms to search for health sources and medical information due to the rapid growth of health information in these platforms [7,8]. It is also crucial to remember that social media use among patients prior to hospital visits is widespread, and people frequently share their online experiences [8,9]. YouTube is one of the mostwell known video sharing web sites that has over 30 billion daily usersand has a lot of videos about healthcare, including ones about diagnosis, treatment, and prevention [10,11]. Recently, TikTok, another video-sharing social media platform, has become apopular sources of health information [12]. TikTok provides easy, quick and widespread access to medical information and reaches more than 1 billion active users [13,14]. Numerous recent studies have examined the quality of health-related content and video features on TikTok and YouTube social media platforms in the literature [15-17].

To our knowledge, no research has examined the accuracy and consistency of the data regarding RA exercises on these platforms. This study was designed to examine and compare the accuracy, quality and video contents of YouTube and TikTok videos related to RA exercises.

Main Points:

- The likelihood of YouTube videos receiving high DISCERN reliability, quality, and overall scores was significantly higher.
- Compared to TikTok videos, physician YouTube uploads were substantially higher.
- When it came to health information, the videos on YouTube about RA exercises were more accurate and of higher quality than those on TikTok.

MATERIALS AND METHODS

The study was designed as a cross-sectional study and examined the content of social medial videos. Since all of the videos are available online and don't feature any human or animal participants, ethics committee approval was not necessary. There are previous studies in the literature using the same protocol [11,18]. After the search history was deleted, the term "rheumatoid arthritis exercise" was sorted on TikTok and YouTube and on July 25, 2023. All searches were performed onthe web-based application with its cache cleared and deleted cookies. To simulate an average search query, the keyword by "top" results on TikTok and by "relevance" on YouTube were used. Videos were included if they were English language, relevant to the RA exercise, and had acceptable audiovisual quality. Non-English videos, duplicated content, videos with no audio, videos unrelated to RA exercise, and advertisements were excluded from the examination. Additionally, videos shorter than 20 seconds were excluded, as viewer engagement decreases significantly in concise videos. Research indicates that the majority of users typically click on the videos located on the first three pages of search results [15,18]. So, after implementing the exclusion criteria, the first 50 videos on each platform were independently reviewed by two researchers (TOC and NK).

The duration of the videos (months of upload), the total number of views, comments, comments per year, likes, shares, and records (for TikTok only), account subscribers/followers, and the length of the videos (minutes) were all recorded for each video. The number of views per year and per like were also calculated for each video content. In addition, daily viewing rate (number of views/video upload time), daily like rate (number of likes/video upload time X 30), and the number of views per daily video popularity (Daily video power index (VPI) [Daily viewing rate x daily like rate / 100]) were calculated for each video. In addition, the video quality was rated as low, medium, and high and the sources of the videos were examined as physicians, non-physician health professionals, trainers, patients/individual users, health-related organizations/websites, and others.

Two tools were used to assess the videos' quality and accuracy: the Global Quality Scale (GQS) and the DISCERN questionnaire. The 16-item DISCERN scale uses a scoring system ranging from 1 (poor) to 5 (good) to evaluate the quality, bias, and reliability of video information. The reliability of the information is evaluated in the first eight questions. The next seven questions evaluate the quality of the information on available treatments, and the final

question relates to the overall quality score. After adding up all 16 questions, the total DISCERN score falls between 0 and 80, and it can be further classified as very poor (<27), poor (27–38), fair (39–50), good (51–62), and excellent (63–80) [19-21].

The GQS isa scoring system consisting 5-point scale (1–5) that is used for the quality analysis. It measures the flow of information, usefulness and educational valueof the videos. In the GQSscoring system, scores 1 and 2 were considered as 'low quality', a score of 3 was considered as 'intermediate quality', while 4 and 5 were considered as 'high quality' [21].

This study also made use of the JAMA (Journal of the American Medical Association) scoring system. It is employed to evaluate the caliber of content on websites pertaining to health [22]. Every criterion carries one point. The criteria are composed of four elements: Authorship, Attribution, Disclosure, and Currency. Points are awarded in a range of 0 to 4. Accordingly, 0 is considered the lowest score because it does not meet the criteria and 4 is considered the highest score because it meets all the criteria. Higher scores obtained in the scoring system indicate that the quality of the evaluated information has increased.

Statistical Analysis

The gathered information was methodically entered into Microsoft Excel spreadsheets (Microsoft Corporation, Redmond, Washington), and SPSS software for Windows version 23.0 (SPSS, Inc., Chicago, Illinois) was used to analyze the information. The study uses counts and percentages to represent categorical variables and mean plus standard deviation or median and interquartile ranges to represent continuous variables. To check if the numerical data confirms to normal distribution, we used the Shapiro-Wilks test. The test revealed that the parameters of the videos on both platforms were not normally distributed. The chi-square test was used to compare categorical data, and the Mann-Whitney U test was used to compare different groups. Utilizing the Kruskal-Wallis test, the categories of the DISCERN, JAMA, and GQS scoring systems were combined. This test was also used to compare video parameters involving more than two independent variable groups. The 'excellent' category of YouTube videos and the 'good' category of TikTok videos were excluded from the comparison since there was only one observation from each of these categories. For correlation analysis Spearman test was performed. "P" values less than 0.05 indicated statistical significance for the obtained results.

RESULTS

A total of 108 videos on TikTok and 78 videos on YouTube were reviewed after the inclusion and exclusion criteria were applied, and the remaining 50 eligible videos on each platform were included in the study (Figure 1).

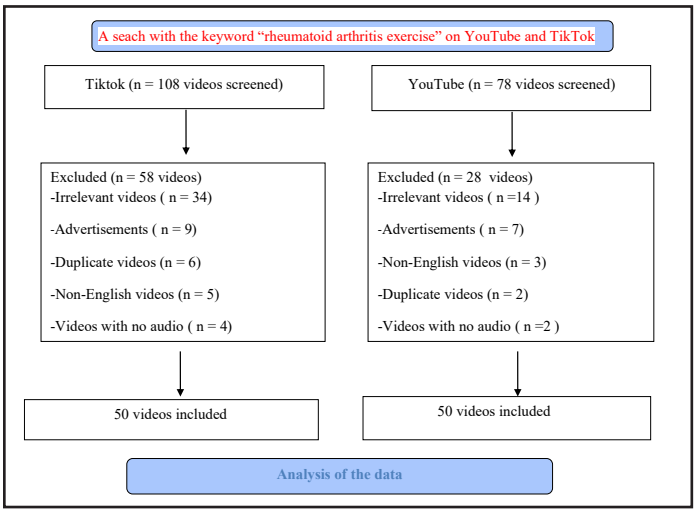

Figure 1. Flowchart of the selection of TikTok and YouTube videos.

In Table 1, the video features were displayed. When comparing YouTube to TikTok videos, there was a significant difference in the likelihood that the former would receive high DISCERN reliability, quality, and overall scores (21,5(11) vs. 15(6), 15(9) vs. 9(4), and 40,5(21) vs. 28(9), p<0.001, respectively). Similarly, YouTube videos had a higher GQS scores that 12 videos (24%) on YouTube and 2 videos (4%) on TikTok were in the high-quality group (p<0.001). Additionally, there was a statistically significant difference in the JAMA scores between TikTok and YouTube videos (2(1) vs. 1(1), p<0.001). When DISCERN classification scores were evaluated, for YouTube videos, 18% were classified as "very poor," 26% as "poor," 34% as "fair," 20% as "good," and 2% as "excellent," while for TikTok videos, 46% were classified as "very poor," 36% as "poor," 16% as "fair," 1% as "good," and 0% as "excellent" (p<0.01).The median video length of the YouTube videos were significantly longer than TikTok videos (12.12 minutes vs. 0.42 minutes, p<0.001). YouTube videos had also more view count (35438 vs. 5989, p<0.001), like count (871.5 vs. 199, p<0.001), annual comments (36.5 vs. 5, p<0.001) and more followers (86050 vs. 16100, p<0.01) when compared to TikTok videos. YouTube videos uploaded by physicians were significantly higher from TikTok videos (34% vs. 14%, p<0.001). On the other hand, patients and

websites/organizations related to health uploaded more TikTok videos (24% vs. 8% and 18% vs. 4%, p=0.003, respectively). The overall quality of YouTube videos were found to be higher on YouTube videos compared to TikTok videos (33 (66%) vs. 12 (24%), p<0.0001). Besides, daily viewing rate and VPI were higher on YouTube videos than TikTok videos (47161,04 vs. 11090,68, p=0.005 and 399085,19 vs. 50752,32, p=0.03).

Table 2 displays the DISCERN classification based on the video features. The findings showed that, in terms of overall safety according to DISCERN categories, there was a statistically significant difference between videos from TikTok and YouTube (p<0.001). We found a significant higher overall quality of treatment according to the DISCERN categories (p<0.001) on both social media platforms. Furthermore, we demonstrated a significant difference between the groups regarding the broadcast's overall quality based on the DISCERN categories and there was a noticeable variance in the quality of TikTok videos among different groups based on the DISCERN categories (p<0.001). When compared to JAMA scores according to DISCERN categories, we showed a statistically significant difference on YouTube and TikTok videos (p<0.001).

The correlation between the JAMA, GQS, DISCERN scoring systems and the number of views, like, daily viewing rate, daily like rate and VPI of YouTube videos is presented in Table 3. There was a statistically significant and positive correlation between the scores and like count, daily VPI and viewing rate. Contrarily, no correlation was found between scoring systems and the number of views, like, daily viewing rate, daily like rate and VPI of TikTok videos (Table 4).

Table 1. Comparison of the YouTube and TikTok video features.

	YouTube (n=50)	TikTok (n=50)	p
	Median (IQR) or n (%)	Median (IQR) or n (%)	
Discern Part 1	21,5 (11)	15 (6)	0,0001*[1]
Discern Part 2	15 (9)	9 (4)	0,0001*[1]
Discern Part 3	3 (2)	2 (1)	0,0001*[1]
Overall DISCERN Score	40,5 (21)	28 (9)	0,0001*[1]
DISCERN Category			
Very Poor	9 (18)	23 (46)	0,001**[2]
Poor	13 (26)	18 (36)	
Fair	17 (34)	8 (16)	
Good	10 (20)	1 (2)	
Excellent	1 (2)	0 (0)	
GQS Criteria			
Low quality	12 (24)	30 (60)	0,0001**[2]
Medium quality	26 (52)	18 (36)	
High quality	12 (24)	2 (4)	
JAMA Criteria	2 (1)	1 (1)	0,0001*[1]
Video length (min.)	12,12 (14,84)	0,42 (0,71)	0,0001*[1]
Video upload time (month)	27 (31)	14,5 (17)	0,0001*[1]
View count	35438 (183043)	5989 (11749)	0,0001*[1]
Comment count	76,5 (173)	9 (15)	0,0001*[1]
Number of comments per year	36,5 (86,75)	5 (11,13)	0,0001*[1]
Like count	871,5 (3012)	199 (442)	0,001*[1]
Number of followers	86050 (443710)	16100 (48700)	0,001*[1]

Uploaders			
Physician	17 (34)	7 (14)	0,003**[2]
Non-physician health worker	11 (22)	7 (14)	
Patient	4 (8)	12 (24)	
Health-related organizations/websites	2 (4)	9 (18)	
Trainer	9 (18)	3 (6)	
Others	7 (14)	12 (24)	
Videos Quality			
Low	4 (8)	5 (10)	0,0001**[2]
Medium	13 (26)	33 (66)	
High	33 (66)	12 (24)	
Daily viewing rate	47161,04 (180071,27)	11090,68 (30012,61)	0,005*[1]
Daily like rate	1181,3 (3052,46)	438,75 (1035,06)	0,135
Daily VPI (Video Power Index) (%)	399085,19 (6803583,92)	50752,32 (425734,53)	0,03*[1]
Monthly comment rate	2,79 (5,63)	0,43 (1,31)	0,002*[1]

*: median (interquartile range (IQR)), **: n (%) [1] Mann Whitney U test, [2] Pearson Chi-square test

Table 2. Comparison of all parameters of videos on both platforms according to DISCERN evaluation categories

DISCERN Score Category		Very Poor Median (IQR) or n (%)	Poor Median (IQR) or n (%)	Fair Median (IQR) or n (%)	Good Median (IQR) or n (%)	Excellent Median (IQR) or n (%)	p
Number of videos	**YouTube**	9 (18)	13 (26)	17 (34)	10 (20)	1 (2)	0,001*[1]
	TikTok	23 (46)	18 (36)	8 (16)	1 (2)	0 (0)	
Discern Part 1	**YouTube**	14 (4)	17 (4)	24 (5)	30 (3)	-	0,0001**[2]
	TikTok	12 (3)	17 (2)	24,5 (2)	-	-	0,0001**[2]
Discern Part 2	**YouTube**	8 (2)	12 (3)	17 (3)	21,5 (3)	-	0,0001**[2]
	TikTok	8 (1)	9,5 (2)	14 (2)	-	-	0,0001**[2]
Discern Part 3	**YouTube**	2 (1)	3 (1)	3 (1)	4 (0)	-	0,0001**[2]
	TikTok	2 (1)	2,5 (1)	2,5 (1)	-	-	0,0001**[2]
Overall DISCERN Score	**YouTube**	24 (6)	30 (7)	44 (7)	54,5 (4)	-	0,0001**[2]
	TikTok	21 (5)	29 (1)	39,5 (5)	-	-	0,0001**[2]
JAMA Criteria	**YouTube**	1 (1)	2 (0)	3 (1)	3 (1)	-	0,0001**[2]
	TikTok	1 (1)	2 (1)	2 (1)	-	-	0,0001**[2]
Video length (min.)	**YouTube**	3,36 (3,82)	8,24 (11,4)	17,06 (10,96)	18,3 (10,6)	-	0,0001**[2]
	TikTok	0,43 (0,7)	0,36 (0,8)	0,415 (0,28)	-	-	0,994[2]
Video upload time (month)	**YouTube**	55 (64)	29 (42)	22 (18)	19 (25)	-	0,025**[2]
	TikTok	13 (16)	18 (18)	16 (22)	-	-	0,659[2]
View count	**YouTube**	31632 (107770)	23481 (173556)	41780 (224079)	56395 (418885)	-	0,828[2]
	TikTok	5553 (14236)	5889 (22059)	7619,5 (8632)	-	-	0,799[2]

Comment count	**YouTube**	22 (114)	34 (84)	84 (193)	180,5 (186)	-	0,057[2]
	TikTok	9 (14)	8,5 (19)	5 (38)	-	-	0,966[2]
Number of comments per year	**YouTube**	7,33 (32,53)	8,25 (71)	42,33 (155,75)	75,665 (163,97)	-	-
	TikTok	5 (10,5)	5,08 (18,25)	4,5 (11,12)	-	-	0,926[2]
Like count	**YouTube**	504 (868)	529 (2511)	1000 (3313)	1150 (5239)	-	0,257[2]
	TikTok	191 (410)	156 (449)	256 (736)	-	-	0,501[2]
Number of followers	**YouTube**	189000 (2335761)	125000 (331350)	53100 (525800)	21100 (281748)	-	0,85[2]
	TikTok	13700 (57347)	12874,5 (45979)	16100 (119972)	-	-	0,742[2]
Daily viewing rate	**YouTube**	17253,8182 (43586,84)	50698,8462 (341225,98)	50136 (194713,39)	85796,0337 (243487,45)	-	0,282[2]
	TikTok	13222,2222 (59580)	9173,8636 (55024,09)	10906,1818 (21801,19)	-	-	0,647[2]
Daily like rate	**YouTube**	321,7021 (795,33)	245,2174 (3416,77)	1411,875 (3918,01)	1660,5319 (3507,52)	-	0,057[2]
	TikTok	480 (1329)	288,1579 (1313,41)	509,9561 (592,79)	-	-	0,349[2]
Daily VPI (Video Power Index) (%)	**YouTube**	62772,5276 (349310,54)	77364,4893 (18691471,29)	535774,72 (8978790,65)	1338203,539 (10511405,92)	-	0,089[2]
	TikTok	55171,875 (1030914,7)	23253,618 (939319,27)	75498,8388 (231412,28)	-	-	0,362[2]
Monthly comment rate	**YouTube**	0,4681 (2,58)	0,6346 (5,97)	3,8485 (8,73)	4,8356 (11,93)	-	0,017**[2]
	TikTok	0,5 (1)	0,4114 (1,7)	0,3868 (1,04)	-	-	0,712[2]

*: n (%), **: median (interquartile range (IQR)) [1] Pearson Chi-square test, [2] Kruskal Wallis test

Table 3. Correlation between JAMA, GQS, DISCERN scoring systems and YouTube video characteristics.

	DISCERN (r; p)	**GQS (r; p)**	**JAMA (r; p)**
Number of views	0,194; 0,177	0,238; 0,095	0,149; 0,303
Like	0,379; 0,007**	0,397; 0,004**	0,293; 0,039*
Daily viewing rate	0,353; 0,012*	0,353; 0,012*	0,258; 0,071
Daily like rate	0,481; 0,0004**	0,442; 0,001**	0,332; 0,019*
Daily Video Power Index	0,441; 0,001**	0,421; 0,002**	0,31; 0,029*

r: Spearman's rho correlation coefficient

Table 4. Correlation between JAMA, GQS, DISCERN scoring systems and TikTok video characteristics.

	DISCERN (r; p)	**GQS (r; p)**	**JAMA (r; p)**
Number of views	0,027; 0,85	0,007; 0,96	-0,038; 0,795
Like	-0,015; 0,916	-0,04; 0,785	-0,094; 0,517
Daily viewing rate	-0,02; 0,891	-0,093; 0,522	-0,123; 0,394
Daily like rate	-0,03; 0,838	-0,116; 0,424	-0,186; 0,197
Daily Video Power Index	-0,008; 0,958	-0,089; 0,537	-0,15; 0,3

r: Spearman's rho correlation coefficient

DISCUSSION

This is the first study to assess the quality, accuracy and video-specific characteristics of YouTube and TikTok videos about RA exercises in the literature. We observed that the quality and accuracy of health information on RA exercises videos is higher on YouTube than on TikTok platform. Moreover, YouTube videos produced by physician were more common. On the other side, TikTok videos had more uploads by health-related organizations/websites and patients.

According to various studies, social media has emerged as a crucial platform for the sharing and exchange of health-related information on a wide range of subjects, and the use of the Internet for health information is growing [8,9,23]. However, given the rapid spread of misinformationon these social media platforms, It is critical to assess the reliability and quality of health-related content on these platforms [24]. Numerous earlier research have looked into social media videos as a source of high-quality health information, with varying degrees of success. For instance, Zengin et al. [25] used the DISCERN and GQS scoring systems to analyze the information quality of musculoskeletal ultrasound videos on YouTube. They found that 40.1% of the videos were of low quality, 20.4% were of moderate quality, and 39.5% were of high quality. In a similar vein, Ozsoy-Unubol et al. [26] discovered that most fibromyalgia-related YouTube videos are of low quality. Some studies report higher rates of high quality videos on YouTube than these studies do. Rodriguez-Rodriguez et al. [27] analyzed 150 YouTube videos and investigated the video popularity, reliability and quality of information using the DISCERN Scale and GQS. They showed that the pelvic floor exercises that are advised following prostatectomy surgery are covered in high-quality YouTube videos. Another social media platform that has gained popularity as a source of health information is TikTok [12]. Some recent studies have reported the quality of health informationon both TikTok and YouTube social media platforms. In this regard, Song et al. [16] stated that TikTok and YouTube videos about gender-affirming surgery ranged from poor to average reliability and quality. In another study by Babar et al. [28] analyzed the first 50 videos on YouTube and TikTok regarding erectile dysfunction treatment and compared the quality of information on each platform. They found that although the quality of the videos on YouTube was higher than that of TikTok, a sizable portion of the content was erroneous. Özkent et al. [15] also examined women urinary incontinence videos on TikTok and YouTube. They discovered that low quality video content from both health care and nonhealth care professionals was available on these platforms; with the median DISCERN score of the videos being higher on YouTube than on TikTok (38 vs. 26). These studies' findings, YouTube videos had a higher likelihood of having higher DISCERN and GQS scores than TikTok videos, are supported by our research.

Based on the findings of our investigation, it was discovered that, in comparison to TikTok videos, YouTube videos had longer durations, more likes, views, and comments. 44% of videos on YouTube and 82% of videos on TikTok were classified as extremely poor or poor quality, respectively, based on the DISCERN classification system. In addition, these videos' scores on YouTube for DISCERN, GQS, and JAMA were substantially higher than those on TikTok. This might be because TikTok videos are shorter than other platforms, which makes it harder to describe the content of videos in greater detail. Because the health care providers uploaded the videos, high-quality ones were more likely to have trustworthy information.

Our study offers that, YouTube videos provide an opportunity to share high-quality information on RA exercise with a large audience. Therefore, it is necessary to provide reliable and understandable videos to viewers created by healthcare professionals. As video sharing websites become an increasingly used source of health-realted information, physicians should give messages to patients about obtaining health information from these platforms.

Limitations

One of the limitation of this study is the usage of DISCERN instrument and GQS scoring system that may be associated with observer bias. Another limitation of our study was a cross-sectional analysis that may have provided different results due to the analyzing of most relavant videos at a single time point. Lastly, we only searched one term "rheumatoid arthritis exercise", but the results may have changed if we have added more terms. The other limitation of this study was that we did not look beyond the videos on the first three pages of search pages, that might have provided better understanding of the role of reliability and quality of the videos. Although the two popular social media platforms were included in the study, it would have been better to include the other video-sharing platforms.

CONCLUSIONS

In conclusion, our findings highlight that RA exercises video

contents on YouTube are more likely to have higher quality and accuracy than TikTok social media platform. Besides, videos produced by physicians were more prevalent on YouTube videos. We consider that it is important to provide videos by healthcare professionals to guide patients about reliable and high-quality health-related information.

Acknowledgements: None.

Conflict of interest: The authors report no relationship that could be construed as a conflict of interest.

Funding: The study did not get any type of financial support.

Ethical Approval: Ethics committee approval was not required as all videos were publicly available online and does not include any human participants or animals.

Author Contributions: Conception: T, OC - Design: T, OC; N, K - Supervision: T, OC; N, K - Fundings: T, OC; N, K - Materials: T, OC; N, K - Data Collection and/or Processing: T, OC; N, K - Analysis and/or Interpretation: T, OC; N, K – Literature Review: T, OC; N, K - Writing: T, OC - Critical Review: T, OC; N, K.

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How to Cite;

Ozudogru Celik T, Koca N (2024) Assessing the Quality and Reliability of Rheumatoid Arthritis Exercise Videos on TikTok and YouTube. Eur J Ther. 30(1):12-20. https://doi.org/10.58600/eurjther1967

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):21-28.
https://doi.org/10.58600/eurjther1874

Original Research

Hippocampal ZnT3 (SLC30A3) Levels Reflect Hippocampal Tissue Damage in Chronic Exercising Diabetic Rats

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Received: 2023-09-26 **Accepted:** 2023-11-07 **Published Online:** 2023-11-07

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This study was presented as an oral presentation at the 17th International Sport Sciences Congress. pp:1263-1265. 13th – 16th November, Aska Hotel, Lara-Antalya-Türkiye, 2019.

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ABSTRACT

Objective: In this study, it was investigated how chronic exercise affects hippocampus tissue damage and ZnT3 levels in diabetic rats.

Methods: The 40 adult rats were used in the study were divided into 4 equal groups: Control (G1), Exercise Control (G2), Diabetes (G3), Diabetes+Exercise (G4). Diabetes was induced in animals in G3 and G4 by injecting intraperitoneal streptozotocin (STZ) twice, 24 hours apart. The animals in G2 and G4 were runed on the rat treadmill for 45 minutes daily for 4 weeks. MDA (spectrophotometric method) and ZnT3 (ELISA method) levels were determined in hippocampus tissue samples obtained from animals sacrificed at the end of the experimental procedures.

Results: In the current study, the highest MDA and lowest ZnT3 levels in the hippocampus tissue were obtained in the diabetes group (G3) ($P<0.05$). Chronic exercise prevented increased hippocampal tissue damage in diabetic rats and reversed decreased ZnT3 levels ($P<0.05$).

Conclusion: The results of our study showed that 4 weeks of chronic exercise could be prevent increased tissue damage in the hippocampus tissue of diabetic rats and ameliorate the decreased ZnT3 levels. The data obtained in this study indicate that ZnT3 levels in diabetic rats may be an indicator of hippocampal tissue damage.

Keywords: Chronic exercise, diabetes, MDA, hippocampus, ZnT3.

INTRODUCTION

Diabetes Mellitus, a chronic metabolic disease characterized by hyperglycemia, insufficient secretion or insufficient action of endogenous insulin, which is a global public health problem [1]. It constitutes 12.2% of all-cause global deaths [2]. As a result of metabolic dysregulation in diabetes, various complications including both macro and micro vascular disorders develop [1, 2]. Oxidative stress increases in both type-1 and type-2 diabetes states. As a result, increased tissue damage plays a role in the development of cardiovascular system-related diseases which is associated with both types of diabetes [3].

Alzheimer's disease (AD) and Type-2 diabetes are both defined as chronic degenerative diseases. In both disease groups, there is a coexistence of pathophysiological events such as insulin resistance, inflammatory stress and amyloid aggregation [4].

Both Diabetes mellitus and Alzheimer's disease increase alarmingly with aging. Accordingly, there is a strong relationship between type 2 diabetes and increased dementia risk [5,6].

AD is also called Type-3 diabetes mellitus (DM) because diabetes is a neuroendocrine disorder that leads to the progression of AD [7]. The term type 3 diabetes is a term used to draw attention to the insulin deficiency and resistance that occurs in the brain in AD [8]. Insulin neurotransmitter release makes synaptic modulation and thus creates learning and long-term memory effects [9]. Autopsies of Alzheimer's patients show decreased insulin in the brain [10]. The risk of Alzheimer's disease is doubled in patients with insulin resistance, metabolic syndrome and type 2 diabetes [10,11].

Especially in diabetic patients, glycation products formed as a result of high plasma sugar that causes neuronal damage due to oxidative stress in the hippocampus [10, 11]. Amyloid plaques are associated with neuronal and synaptic loss in Alzheimer's disease [12]. Regular exercise reduces the signs of Alzheimer's disease in individuals with brain amyloid findings. As a result, it has been reported that physical activity reduces the risk of Alzheimer's disease and has a positive effect on mortality [12, 13].

ZnT3, a zinc transporter protein, is critical in the transport of zinc to the synaptic vesicles of a group of glutamatergic neurons in the brain tissue, especially the hippocampus and neocortex [14]. ZnT3 contributes to the protection from aging-related cognitive losses due to its critical role in zinc regulation [15]. ZnT3 gene expression decreases significantly with age [16], Alzheimer's disease [17, 18], Parkinson's disease and dementia [14]. Consistent with these results, aged mice lacking the ZnT3 gene have loss of cognitive performance. As a result, these mice show difficulties in learning and memory [19-21]. It has been reported that ZnT3-KO mice show decreased progenitor cell proliferation and neuroblast production induced by hypoglycemia [22]. It has also been reported that there are fundamental changes in the expression of proteins and genes important in neuronal transmission in Znt3-KO mice [23]. Zinc deposited in synaptic vesicles by ZnT3 has been shown to play a fundamental role for presynaptic Erk 1/2 signaling during hippocampus-dependent learning [21]. In addition, studies with mice with mutated zinc-binding domains of neurotransmitter receptors have shown that synaptic zinc activated by ZnT3 is important [24]. Synaptic zinc may contribute to amyloid deposition in an age-dependent manner [19]. Thus, appropriate delivery of zinc to synaptic vesicles by ZnT3 may play a critical role in preventing the onset of Alzheimer's disease.

Main Points;

- In our study, increased hippocampal MDA and decreased hippocampal ZNT3 levels in diabetic rats were reversed by 4 weeks of moderate-intensity chronic exercise.
- The data obtained in our study suggest that hippocampal ZnT3 levels may be a marker of hippocampal tissue damage.
- The current study is the first study to evaluate diabetes-exercise-hippocampus and ZnT3 together.

The aim of this study was to investigate the relationship between hippocampus ZNT3 levels and hippocampal tissue damage in diabetic rats undergoing chronic running exercise.

MATERIALS AND METHODS

Study Groups and Animal Material

The research was carried out at Board of Selcuk University Experimental Medicine Research and Application Center. The study protocol was approved by the (2018-14). Ethics Committee (Decision Number: 2018-14, Meeting date 27.04.2018). 40 adults male Wistar rats were used in the study and divided into 4 equal groups. Control (G1), Exercise Control (G2), Diabetes (G3), Diabetes+Exercise (G4).

Induction of Diabetes in Experimental Animals

Diabetes groups were formed by randomly selecting 20 rats used in the study. Rats were injected intraperitoneally with 40 mg/kg streptozotocin (STZ) "Sigma, S-0130" twice, the same dose at 24-hour intervals. Six days after the second injection, blood glucose levels were measured from the tail veins of the animals using a diagnostic glucose kit. Animals with blood sugar levels of 300 mg/dl and above were considered diabetic [25].

Running Exercise

Chronic running exercises in experimental animals were performed on a rat treadmill.

The treadmill mechanism, where the running exercises were performed, was designed so that eight animals, separated from each other by glass partitions, could run at the same time. The treadmill was equipped with technical equipment that allowed the electrical impulse stimulation to be set at low intensity to

encourage the rats to run. The exercises were started 48 hours after diabetes was established in the rats and were performed as chronic running exercise for forty-five minutes a day for four weeks. Exercises performed in rats between 30 minutes and 60 minutes are defined as moderate intensity exercise [26]. Consistent with exercise intensity, this sports activity causes moderate stress in rats [26]. Based on this point, we planned the exercise duration of the rats as 45 minutes of daily running exercises. This application was made to minimize stress factors in rats. To accustom the rats to both the treadmill and running exercises, the animals were trained to run at a speed of 15 m/min for 15 minutes for two days before starting chronic running exercises.

Afterwards, the animals were run at 20 m/min for 45 minutes per day for 4 weeks [27]. With intramuscular administration of a combination of Ketalar (60 mg/kg), Parke-Davis and xylazine (5 mg/kg) "Rompun, Bayer" to avoid animal suffering 24 hours after the last running exercise, the animals were sacrificed under general anesthesia. Hippocampus tissue samples were taken from sacrificed animals. Chronic exercise practices; It was applied to Exercise Control (G2) and Diabetes+Exercise (G4) animals. Control (G1) and Diabetes control (G3) animals were not exercised.

Biochemical Analysis

Determination of Tissue Malondialdehyde (MDA) Levels

Although MDA is not a specific analysis method for fatty acid oxidation, it correlates strongly with the degree of lipid peroxidation. For this reason, it is a very common measurement method. In our study, we determined MDA levels in the hippocampus tissue as an indicator of tissue damage. We used the TBA (thiobarbituric acid) technique, which is the analysis method of Uchiyama and Miharama [28], which is also the most used method in MDA analysis. Tissue MDA results were determined as nmol/gr tissue in spectrophotometer [28].

Analysis of ZnT3 in Hippocampus Tissue by ELISA

After weighing the hippocampus tissue to be analyzed, it was put into tubes. It was homogenized with phosphate buffer at pH=7.4 in Misonix's Microsan Ultrasonic Homogenizer at 4˚C. The obtained homogenates were centrifuged according to the analysis. Analyzes were performed with the Elisa test kit, brand Bioassay Technology Laboratory, catalog number E235Ra.ZnT3 levels were calculated as ng/g tissue.

Statistical Evaluations

Statistical analysis of the data obtained in the study was performed with a computer package program (SPSS 22.0). The arithmetic mean and standard deviations (SD) of all data were calculated. The homogeneity of the data was confirmed by applying the "Shapiro-Wilk" test. One-Way Analysis of Variance was used to determine the difference between groups, and the Bonferroni test was used to determine which group caused the difference. Differences at $P<0.05$ level were considered significant.

RESULTS

In our study, the highest hippocampal MDA values and the lowest hippocampal ZnT3 values were obtained in the diabetes control group (G3) ($P<0.05$). Hippocampal MDA and ZnT3 values of the control (G1), exercise control (G2) and exercise diabetes (G4) groups were not different from each other (Figures 1, 2).

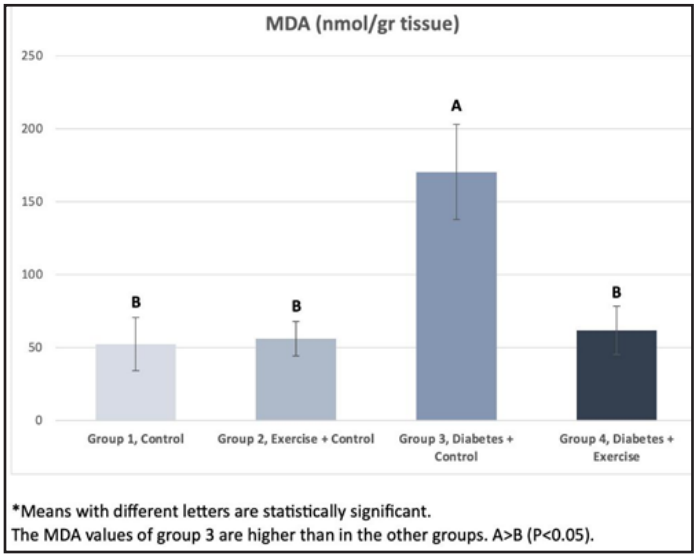

Figure 1. Hippocampal tissue MDA levels of study group

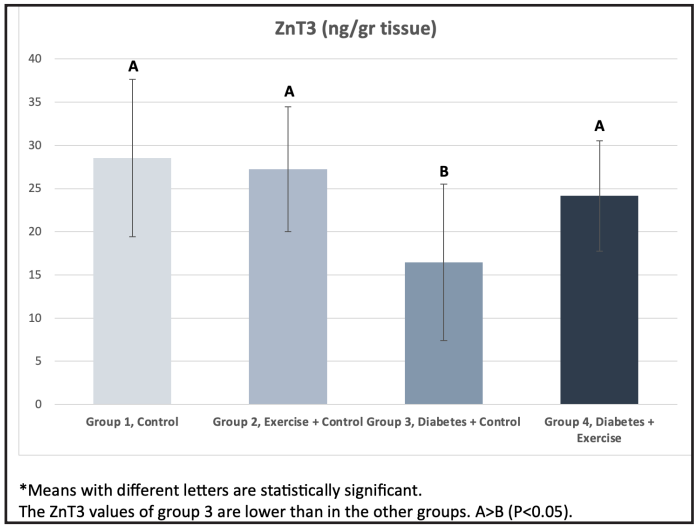

Figure 2. Hippocampal tissue ZnT3 levels of study group

Discussion of the Hippocampus MDA Parameters of the Study Groups

Hyperglycemia in diabetes weakens the antioxidant capacity in the body and facilitates the production of free radical products. For this reason, diabetic patients are more sensitive to oxidative stress [29]. In addition, hyperglycemia can lead to protein modification through the production of reactive oxygen species (ROS) during protein glycation, indicating that lipid peroxidation products may play a role in the complications of diabetes [29]. One of the structures most sensitive to diabetes is the hippocampus. Diabetes-related complications may cause degeneration of synaptic plasticity in the hippocampus [30]. Additionally, diabetes and related complications are shown as a risk factor for the deterioration of cognitive performance [30]. With the prolongation of the life expectancy of diabetic patients (especially those with Type 2 diabetes), cognitive impairment and dementia have become new complications of diabetes patients. Interestingly, diabetic patients are at approximately 60% higher risk of developing dementia than those without diabetes [31, 32]. Therefore, there is an increasing interest in investigating the relationship between diabetes and the hippocampus [32]. In our study, diabetes resulted in increased MDA levels in the hippocampus of rats. Possible mechanisms linking diabetes and depression have recently been found. One of these mechanisms is the increase in lipid peroxidation in the hippocampus [33]. Similarly, Kim et al. [29] showed that diabetes increases lipid peroxidation in the hippocampus. The results of our study show that diabetes increases hippocampal tissue damage within a period of 4 weeks in rats. This finding is in line with the findings of the above researchers, who suggested that diabetes affects hippocampal functions by causing neuronal damage. Again, our study shows that 4-week chronic exercise prevents oxidant damage in the hippocampus in diabetic rats. In our study, 4 weeks of moderate-intensity chronic exercise led to a significant decrease in hippocampal MDA levels when compared to non-exercise diabetic rats. Newsholme et al. [34] reported that exercise can improve metabolic and inflammatory outcomes by preventing oxidative stress in diabetes. This finding is consistent with the decreased MDA levels we obtained in exercised diabetic rats in our study. Reporting that increased hippocampal tissue damage in diabetes can be prevented by treadmill exercise [29] is an important finding that supports the decreased hippocampal MDA levels we obtained in diabetic rats that underwent chronic running exercise in our study.

Discussion of the Hippocampus ZNT3 Parameter of the Study Groups

In our study, the lowest ZnT3 levels in the hippocampus were obtained in diabetic rats. We could not find any studies directly on the relationship between diabetes, hippocampus and ZnT3 in Medline scans. However, it has been reported that there are changes in the levels of some zinc transport proteins, including ZnT3, in diseases such as Alzheimer's and diabetes [35]. It has also been shown that ZnT3 can also be expressed in pancreatic beta cells outside the brain [36]. In addition, it has been reported that there is a significant decrease in ZnT3 expression in brain tissue due to aging, which may be important in the relationship between aging and AD [37]. In this study, the idea of determining the hippocampal ZnT3 parameter in rats with diabetes was born for two reasons. First, diabetic patients exhibit features such as cognitive impairment and dementia [31, 32]. The second is that the risk of developing Alzheimer's disease is 60% higher in diabetic patients than in people without diabetes [8, 38]. Therefore, the decreased ZnT3 levels we obtained in diabetic rats can be considered as a very interesting and important finding. It is already known that the role of ZnT3 in cognitive functions and events such as Alzheimer's is critical [16]. The formation of beta amyloid plaques lies at the basis of the pathology of Alzheimer's disease. Beta amyloid plaques (amyloid fibrils) accumulate especially in the hippocampus and neuronal cortex [39]. Loss of function of ZnT3 has a critical place in the formation of amyloid plaques. Presynaptic glutamatergic vesicles contain high levels of zinc through ZnT3, which is localized in the vesicles [36]. As a result, one of the important factors leading to the formation of amyloid plaques in Alzheimer's disease is abnormal changes in free zinc levels [40]. It was suggested that this abnormal zinc regulation occurs in two phases. First, inhibition of zinc uptake leads to changes in zinc homeostasis. The corresponding increase in presynaptic zinc leads to increased oligomerization and insolubility with amyloid β [41]. Second, dysregulation of zinc homeostasis results from an inhibition of zinc transport leading to high intracellular zinc levels [42]. Recently, Deshpande et al. [43] showed that the formation of hippocampal amyloid β plaques was significantly increased in mice lacking the ZnT3 gene compared to normal mice, revealing the importance of ZNT 3 in the development of Alzheimer's. In conclusion, the low hippocampal ZNT3 levels we obtained in diabetic rats are a very critical and original finding in this respect.

More interestingly, 4 weeks of moderate-intensity chronic exercise in our study prevented the decrease in hippocampal ZnT3 levels when compared to non-exercise diabetic rats. Amyloid plaques are associated with neuronal and synaptic loss in Alzheimer's disease [12]. Regular exercise reduces the signs of Alzheimer's disease in individuals with brain amyloid findings. As a result, it has been reported that physical activity reduces the risk of Alzheimer's disease and has a positive effect on mortality [12]. With this aspect, the fact that 4 weeks of moderate-intensity chronic exercise in diabetic rats prevents the decrease in hypompal ZNT3 levels in diabetic rats may be critical information in the relationship between diabetes-Alzheimer's-exercise. In the study of Kim et al. [29]; the findings that diabetes increases lipid peroxidation, whereas treadmill exercise can reduce diabetes-induced oxidative damage in the hippocampus is a report that indirectly supports the increased hippocampal ZNT3 levels we obtained in diabetic rats in our study. Based on the fact that chronic exercise prevents hippocampal tissue damage caused by diabetes in the current study, it can be suggested that chronic exercise may be beneficial in delaying Alzheimer's disease, which is more common in diabetic elderly people.

Limitation

The limiting factor in the current study is that the effect of chronic exercise on histological changes in hippocampal tissue in diabetic rats was not demonstrated. Revealing the relationships between histological changes in hippocampus tissue and diabetes and chronic exercise may provide us with more original information.

CONCLUSION

In our study, increased hippocampal MDA levels in diabetic rats were prevented by 4 weeks of moderate-intensity chronic exercise. Again in the present study, significantly suppressed hippocampal ZnT3 levels in diabetic rats were reversed by 4 weeks of moderate-intensity chronic exercise. Based on the data obtained in our study, we suggest that hippocampal ZnT3 levels may be a marker showing hippocampal tissue damage. Based on Medline scans; We can say that our study is the first study in which diabetes-exercise-hippocampus- and ZnT3 were evaluated together.

Funding: This study was supported by the Scientific Research Projects Coordinatorship of Selcuk University (SUBAPK; project no. 18202032).

Acknowledgments: This study was presented as an oral presentation at the 17th International Sport Sciences Congress. pp:1263-1265. 13th – 16th November, Aska Hotel, Lara-Antalya-Türkiye, 2019.

Conflict of interest: The authors declare that they have no potential conficts of interest to disclose.

Informed Consent: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Compliance with Ethical Standards: This study was conducted in accordance with the Declaration of Helsinki. The study protocol was approved by the Experimental Animals Ethics Board of Selcuk University Experimental Medicine Research and Application Center (2018-14). This research was performed on the animals (rat). Meeting date 27.04.2018).

Author Contributions: Conception: SBB;RM;AKB – Design:RM; AKB - Supervision:RM; AKB- Fundings: -Materials:MY - Data Collection and/or Processing:EM; SBB; OU - Analysis and/or Interpretation:EM; SBB; OU-Literature:MY; SBB - Review:MY; SBB - Writing:SBB- Critical Review:RM;AKB.

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How to Cite;

Baltaci AK, Yasli M, Baltaci SB, Mogulkoc R, Menevse E, Unal O (2024) Hippocampal ZnT3 (SLC30A3) Levels Reflect Hippocampal Tissue Damage in Chronic Exercising Diabetic Rats. Eur J Ther. 30(1):21-28. https://doi.org/10.58600/eurjther1874

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):29-38.
https://doi.org/10.58600/eurjther1919

Original Research

Micro-Computed Tomographic Evaluation of the Sealing Quality and Bond Strength of Different MTA Apical Plugs

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Received: 2023-11-07 / **Accepted:** 2023-12-18 / **Published Online:** 2023-12-18

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ABSTRACT

Objective: This study aimed to compared the effects of different placement techniques to the sealing quality of mineral triokside aggregate (MTA) apical plugs at apexification technique by micro-computed tomography (micro-CT) and compared the bond strength to root dentin of an injectable MTA (BIOfactor MTA), MTA Angelus and AH Plus.

Methods: Sixty dentinal root slices were obtained from 20 maxillary centrals.A canal-like hole was drilled into each slices canal space.The samples were divided into 3 groups (n=20).All materials were delivered into the holes. Push-out tests were performed and fracture types were analysed with a strereomicroscope. In the second part of the study,72 maxillary central teeth with standardised artificial divergent open apex were divided into 4 groups; MTA Angelus and BIOfactor MTA were mixed mechanically, and introduced to form 4 mm thick apical plugs by hand condensation or indirect-ultrasonic activation for 10 seconds. Incidence of external voids between dentin walls and MTA apical plugs and porosity inside MTA were determined by volumetric analysis with micro computerized tomography (micro-CT).

Results: No significantly difference was found between the bond strength values of the materials (p:0.370; p>0.05).The external voids and porous voids are similar in both MTA (p: 0.685; p>0.05). When indirect-ultrasonic activation was applied,there was significantly less porosity statistically than hand condensation (p:0.00; p<0.05).

Conclusion: MTA Angelus and BIOfactor MTA materials showed similar results in terms of bond strength to root dentin, fracture types, adaptation to dentin walls and structural porosity rate. Both MTA materials showed less structural porosity when placed by indirect ultrasonic activation technique compared to manual condensation.

Keywords: Apical plug, Micro CT, MTA, Push-out

INTRODUCTION

Torabinejad developed MTA as a root-end filling material in 1993 and it has started to be used to create an apical barrier in single-visit apexification treatments owing to its superior biocompatibility and sealing ability. MTA is also used in many other dental treatments, such as vital pulp treatments, root-end filling material, and perforation and resorption repair, because of its advantageous properties, such as its outstanding sealing ability, superior biocompatibility, marginal adaptation, and tissue regeneration [1–3].

However, despite all its advantages, it is difficult to fill a narrow

root canal with MTA. The use of a lentulo spiral and MTA carrier has been tried, but applying MTA to a narrow root apex can still be difficult and time-consuming. In addition, although MTA is condensed with hand tools, its inability to penetrate the dentinal tubules adequately, its sandy feature, and the fact that it cannot be removed from the canal after hardening make it impossible to use in a complex canal system and retreatment [4]. An insufficient water-to-powder ratio and insufficient mixing also prevent MTA from adapting to the canal wall [5].

To increase the canal wall adaptation of MTA, placement techniques have been suggested using direct and indirect ultrasonic activation methods [6,7]. Especially when used to form an apical plug, different materials have been sought due to problems such as the short working time during application to the tooth, the difficulty of transport and placement in the cavity, and insufficient and heterogeneous condensation in the apical region [8,9]. Recently, BIOfactor MTA (Imicryl Dental, Konya, Türkiye), has been used for pulpotomy, pulp capping, root perforation repairs, root-end filling, and apical plug procedures. BIOfactor MTA can be prepared in different fluency depending on the treatment method. According to the manufacturer, BIOfactor MTA does not cause tooth discoloration and has a stronger seal, shorter curing time, easier handling properties, and finer powder for faster hydration [10,11].

MTA placement in teeth with divergent open apex is known to be a technique-sensitive procedure, and the most successful placement technique for MTA material has not yet been defined [12]. In addition, there is little information about the relationship between the placement technique of MTA applied as an apical plug and the quality of the plug.

Main Points;

- MTA is a material used in dentistry in many areas such as direct pulp capping, regeneration, apexification and repair of perforation and resorption.
- Thanks to its advantages such as ease of mixing and application to the tooth, injectable MTA shortens the procedure time and reduces the risk of contamination.
- The bond strength of injectable MTA (BIOfactor MTA) to root dentin was found to be similar to that of MTA Angelus. When the fracture types after bond strength were analysed, the results of both MTA materials were similar and the most common type of fracture was adhesive failure.
- In MTA placement with indirect ultrasonic activation, porosities within the MTA and between the MTA and the dentin wall were found to be statistically less than in MTA placement with hand condensation.

This study aims to evaluate the effect of different application techniques on the sealing property and porosity of the apical plugs of two different MTA materials (MTA Angelus and BIOfactor MTA) using microcomputed tomographic imaging using micro-CT. In addition, the bond strength of these materials to root dentin is evaluated by comparing the materials with an epoxy resin-based root canal filling paste (AH Plus) using the push-out bond strength test method.

The research hypotheses were that there is no significant difference between the two MTA materials when used as apical plugs in terms of adaptation and structural porosity ratios of cements to dentin and their bond strength to root dentin.

MATERIALS AND METHODS

Ethical approval was obtained from Selçuk University Clinical Research Ethics Committee (2017-09/14). Using G*Power 3.0.10 statistical software (v.3.1.9.7), a minimum sample size of 72 (minimum 18 for each group) for micro CT analysis and a minimum sample size of 60 (minimum 20 for each group) for thrust ligament strength were calculated for an effect size of 0.4 and 80% statistical power at a significance level (α) of 0.05. A total of 92 upper incisors extracted for orthodontic or periodontal reasons— 20 for the push-out test and 72 for the micro-CT— were included in the study. To remove the attachments on the root surfaces of the teeth, a periodontal curette, a rotating rubber cap, and pumice-water slurry were used. The teeth, which were kept in 5.25% sodium hypochlorite (NaOCl) for 1 hour for disinfection, were kept in physiological saline until use.

Push-out Test

Sample Preparation

The surface-cleaned 20 teeth were sectioned from the cementoenamel junction (CEJ) with a diamond saw. The obtained tooth roots were fixed on acrylic blocks, which were placed in a precision sectioning saw (IsoMet 1000; Buehler, Lake Bluff, NY, USA). Three horizontal cross sections (1 ± 0.05 mm thick) were obtained from the upper and middle third segments by sectioning vertically to the long axis, using a diamond disk under water cooling (125 x 0.35 x 12.7 mm; Buehler Ltd). In total, 60 root slices were drilled with 1.3 mm cylindrical carbide burr

(Dentsply Maillefer, SA CH-1338, Ballaigues, Switzerland) to obtain standardized cavities in the root canal space. All samples were kept in a 2.5% NaOCl solution for 15 minutes and then bidistilled water for 1 minute. To remove the smear layer, the samples were immersed in 17% EDTA (Titriplex@III, Merck, Darmstadt, Germany) for 3 minutes, bidistilled water for 1 minute, 2.5% NaOCl for 1 minute, and finally bidistilled water for 1 minute. The holes were dried with absorbent paper points. The specimens were randomly divided into three groups (n = 20). MTA Angelus (Soluçoes Odontologicas, Londrina, Brazil), BIOfactor MTA (Imicryl, Konya), and a control group using AH Plus (Dentsply DeTrey, Konstanz, Germany) were prepared according to the manufacturer's instructions (Table 1) and applied into the cavities with gentle vibration**.** Finally, specimens were stored in contact with a phosphate-buffered saline solution (PBS) (pH 7.2) at 37 °C and 100% humidity for 7 days.

Push-out Test

To evaluate the push-out bond strength, a 1 mm diameter cylindrical stainless steel piston tip in a universal testing machine (Instron, Norwood, MA, USA) was placed on the tested material without touching the root dentin wall. A 1 mm/min speed load was applied on fillings only in an apical coronal direction until dislocation occurred. The maximum load at filling failure, noted in newtons, was converted to megapascals (MPa) by using the following formula: newtons/(2π rh), where π is the constant 3.14, r is the radius of the intra-radicular space, and h is the height of section in millimeters (Figure 1).

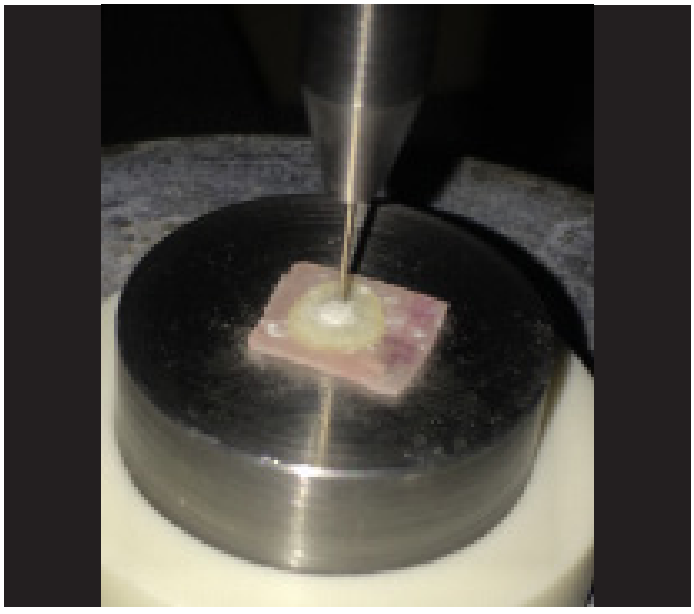

Figure 1. One sample was positioned to undergo the push-out test.

Stereomicroscopy Analysis

After the push-out test, the coronal and apical faces of all sections were analyzed by a single examiner under a stereomicroscope (SZ-PT Olympus, Osaka, Japan) in x25. The types of failure observed in the sections were divided into three categories in terms of breaking type: adhesive failure between MTA and dentin interface, cohesive failure within the MTA, and mixed failure, a combination of the two.

Micro-CT Test

Sample Preparation

Surface cleaned 72 teeth were cut from the CEJ with a diamond saw so that 13 mm long standard tooth samples were prepared. The apical 2 mm section was cut with a diamond fissure burr (Maillefer, SA CH-1338, Ballaigues, Switzerland) to eliminate and standardize the presence of any apical delta under water cooling. The canal length was determined visually with stainless steel #15 K mesh files (Mani, Tochigi, Japan) 0.5 mm shorter than the apex. A protaper rotary system (Dentsply, Maillefer, Ballaigues, Switzerland) of F1–F5 files (Dentsply, Tulsa Dental, Tulsa, OK) was used for the cleaning and biomechanical preparation of the root canals of the prepared teeth. The canals were irrigated with 2 mL of saline and 2 mL of 2.5% NaOCl at each file change. Retrograde preparation for simulation of open apex, using 1-4 no. Gates-Glidden burrs (Mani, Tochigi, Japan) was conducted. During the procedure, tooth roots were maintained with saline-impregnated gauze. The divergent shape of the apices of the sample teeth whose biomechanical preparation processes were completed was checked with digital radiographs. Prepared teeth were kept in PBS until use. The 72 teeth were divided into four study groups (n = 18 each) as follows:

Group 1: MTA Angelus + hand condensation (Angelus-Manuel)

Group 2: BIOfactor MTA + hand condensation (BIOfactor-Manuel)

Group 3: MTA Angelus + indirect ultrasonic activation (Angelus-Ultrasonic)

Group 4: BIOfactor MTA + indirect ultrasonic activation (BIOfactor-Ultrasonic)

Mechanical Mixing

For standardization, 1 g of powdered MTA and 0.34 g of distilled water from all groups were mixed in amalgam capsules (Ruby Cap II, Istanbul, Türkiye) for 30 seconds at 4500 rpm in an amalgamator (YDM Amalgamator Hangzhou Yinya New Materials Co., Ltd., China), according to the in vitro model applied by Sisli and Ozbas [13].

Table 1. Compositions of tested materials and instructions for use

Product and manufacturer	Lot Number	Composition	Instructions for use
MTA Angelus (Angelus Industria de Produtos Odontologicos, Londrina, Brazil)	17897	Powder: tricalcium silicate, dicalcium silicate, tricalcium aluminate, calcium oxide, bismuth oxide Liquid: distilled water	Mix 1 scoop of powder with 1 drop of distilled water for 30 seconds
BIOfactor MTA (Imicryl Dental, Konya, Türkiye)	18201	Powder: tricalcium silicate, dicalcium silicate, tricalcium aluminate, calcium sulfate hemihydrate, and ytterbium oxide for radiopacity. Liquid: 0.5%–3% hydrosoluble carboxylated polymer, demineralized water	Mix 3 scoops of powder with 1 drop of liquid until having a homogeneous consistency
AH-Plus (Dentsply DeTrey, Konstanz, Germany)	1511000326	Base: epoxy resin, calsium tungstat, zirkonium oxside, silicate, ferric oxide pigments Catalyst: amines, calsium tungstat, zirkonium oxside, silicate, silikone fluids	Using a metal spatula, mix the two pastes in equal volumes (1:1) until having a homogeneous consistency

Hand Condensation

MTA was delivered using an MTA carrier (MAP; Produits Dentaires, Vevey, Switzerland) to the root canals. MTA was placed conventionally with size 3 and 4 pluggers until the apical plug was 4 mm.

Indirect Ultrasonic Activation

During the transfer of MTA into the canal in layers with MAP, indirect ultrasonic activation was applied by placing a size-1 plugger in the center of the material while avoiding contact with the walls, and a CPR-1 ultrasonic tip (Ellipson type; Satelec, Acteon group, Merignac, France) was placed in contact with the plugger. The piezoelectric ultrasonic unit (Suprasson P5 Newtron, Acteon Group, Mount Laurel, NJ) was then activated for 10 seconds at 25 kHz. All steps were repeated until the thickness of the MTA plug was 4 mm.

The thickness and density of the MTA apical plug were checked radiographically. Moist cotton pellets and a 3 mm temporary restorative material (Cavit, 3M ESPE, D-8031 Seefeld, Germany) were placed in the coronal part of the canal to ensure complete hardening of the MTA and kept in a 100% humidity environment at 37 °C. Temporary fillings placed on the sample teeth were removed in all study groups after 3 days. The root canal filling of the sample teeth was completed with the lateral condensation technique using AH Plus, a resin-based canal filling paste, and gutta percha (Diadent, Korea). The glass ionomer cement placed into access cavity. All samples were kept at 37 °C at 100% humidity for 7 days.

Micro-CT Imaging and Analysis

A new generation micro-CT device, the SkyScan 1272 (SkyScan 1272, Kontich, Belgium) was used, along with N-recon software (SkyScan 2010, Aartselaar, Belgium) and CTAn software (CT Analyser, SkyScan, Aartselaar, Belgium). Samples with root canal fillings were carried out by adjusting the X-ray source of the device at 80 kV and 120 μA power; exposure lasted 3.1 seconds with a 0.5 mm thick Al filter, 0.4° rotation, and 180° vertical rotation angle. As a result of the scans, 537 tagged images of each sample were obtained in TIFF format. By combining these raw images with the N-recon program, approximately 600 cross-sections in BMP format were obtained, allowing the internal structure of each sample to be examined. The obtained sections were transferred to the CTAn program. The volumetric ratios of the spaces' external voids between the MTA and the dentinal walls, the porosity inside the MTA of the samples prepared using the Region of Interests, and the threshold data determined by the CTAn program were calculated separately.

Statistical Analysis

IBM SPSS statistics software 15.0 was employed to analyze the tested group.

Statistical Analysis of Push-Out Test

According to the Kolmogorov-Smirnov test result, the data showed normal distribution (p-value = 0.820 > 0.05). A one-way Analysis of Variance (ANOVA) test was applied for the MPa values of the three groups. Statistical difference was shown at the 0.05 significance level.

Statistical Analysis of Micro-CT Testing

According to the Kolmogorov-Smirnov test result, the data showed normal distribution (p-value = 0.820 > 0.05). An Independent-Sample T-test was used for the porosity values of the groups. Statistical difference was shown at the 0.05 significance level.

RESULTS

Results of Push-Out Test

Table 2 shows the mean and standard deviations for each group. No significantly difference was found between the bond strength values according to the results of the one-way ANOVA test (p = 0.370 > 0.05). Under the stereomicroscope, cohesive- and mixed-type failures were seen more and at equal rates than the adhesive-type failure in the MTA Angelus and BIOfactor MTA groups (Figure 1). The most cohesive-type failures were observed in the AH Plus group (Table 3).

Table 2. Means of bond strength (MPa) and Standard Deviation of tested materials

Groups	n	Mean(MPa)	Std. Dev.
MTA Angelus	20	5,809a	0,712
BIOfactor MTA	20	5,575a	0,486
AH Plus	20	6,657a	0,465

Table 3. Failure types

Groups	Failure Types (%)		
	Adhesive	Cohesive	Mix
MTA Angelus	4(%20)	8(%40)	8(%40)
BIOfactor MTA	4(%20)	8(%40)	8(%40)
AH Plus	2(%10)	12(%60)	6(%30)

Results of Micro-CT Analysis

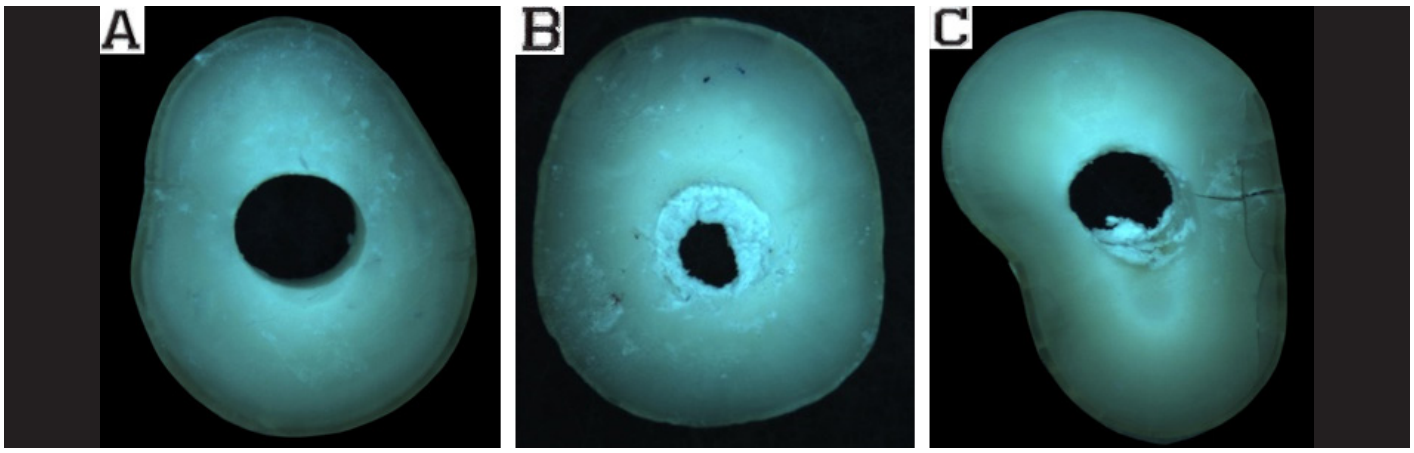

Figure. 2. Stereomicroscope images of the failure modes from each group: Adhesive failure(A), Cohesive failure (B), and Mix failure(C)

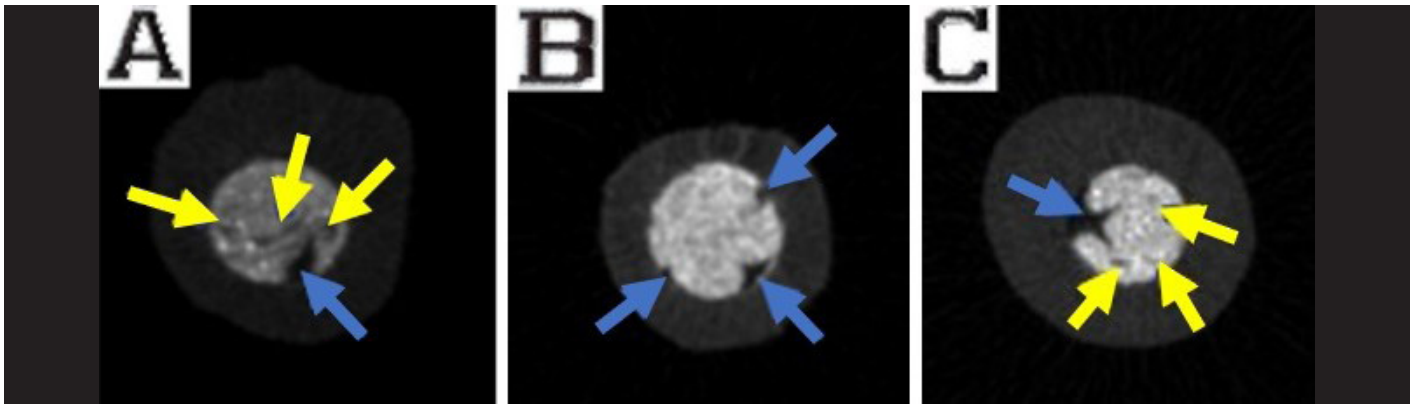

Figure. 3. Representative sections obtained in the N-recon program: Blue arrows show external voids which between the dentin walls and MTA and yellow arrows show porous voids inside the MTA.

Representative sections obtained from samples are shown in Figure 2 A-C. The medians and standard deviations as percentage values for each group are presented in Table 4. Where MTA Angelus and BIOfactor MTA were placed using the indirect ultrasonic activation technique, the external voids were found to be statistically significantly lower ($p < 0.05$). However, no significantly difference was found between them in terms of porous voids ($p > 0.05$). There was no statistically significant difference between the MTA Angelus and BIOfactor MTA groups placed with the hand condensation technique in terms of external voids or porous voids ($p > 0.05$).

Table 4. The external voids between the dentinal walls and MTA, the porosity inside the MTA percentage values (%)

	External voids between dentin walls and MTA (%)	Porous voids inside MTA (%)
Group	Mean ± Std Dev.	Mean ± Std Dev.
1 Angelus-Manuel	6,383±0,931[a]	0,672±0,194 [a]
2 BIOfactor- Manuel	6,828±0,691 [a]	0,685±0,107 [a]
3 Angelus- Indirect	3,165±0,379[b]	0,687±0,168 [a]
4 BIOfactor-Indirect	2,836±0,360 [b]	0,793±0,101 [a]

*Different letters in the same row mean the presence of statistically significant difference.

DISCUSSION

The study hypothesis was accepted because no significantly difference was found between the MTA Angelus and injectable BIOfactor MTA in terms of adaptation and structural porosity ratios of types of cement to dentin, and their bond strength to root dentin when used as an apical plug.

MTA is a successful apical plug with strong chemical and physical properties; it has become the most preferred material in the single-visit apexification technique for open apex teeth, thanks to its superior sealing, biocompatibility, and regenerative properties [14,15]. Giuliani et al. stated that apexification treatments with MTA were completed in a shorter time, the recovery time was shortened, and appointments were decreased [16]. Despite all the advantages of MTA, studies are continuing to strengthen its physical properties and improve the application technique. In this study, to evaluate the factors that will affect the success of apical plugs using MTA Angelus and BIOfactor MTA, the sealing ability and porosity when different placement techniques were used and bond strength to root dentin were investigated.

Adhesion of the endodontic repair material to the root dentin and sealing efficiency is directly proportional, and as they increase, the filling–dentin interface gets stronger, and the success of the treatment increases. In addition, the properties of the tooth, the application technique, and the material properties affect the quality of the dentin bond. Although there are many methods to measure the bond strength of endodontic materials to dentin, it has been reported that the push-out bond strength test is an effective, and practical method [17]. In this study, the dentin bond strengths of MTA materials were compared with the AH Plus-control group using the push-out test. Samples were prepared as in the study of Ersoy et al. [18]. In the literature, the bond strength values of MTA to root canal dentin have been reported as being between 1.66 and 9.46 MPa [19]. In this study, the bond strengths to root canal dentin were found to be 5.809 MPa for MTA Angelus and 5.575 MPa for BIOfactor MTA, both of which are within the above mentioned range; there is no statistical difference between them. According to the manufacturers, since the basic compositions of calcium-silicate-based materials are similar, their bond strengths are also similar. The bond strength of AH Plus was found to be the highest, at 6.657 MPa. The higher resistance of AH Plus to dislocation has been demonstrated previously [9], and this may be due to the formation during the mixing of a hard and strongly cross-linked polymer from a covalent bond between the diepoxide compounds and the polyamine paste [20].

There are not many studies in the literature comparing the dentin bond strength of BIOfactor MTA. In a study evaluating the bond strength using MTA Angelus, Biodentine, and BIOfactor MTA materials, root dentin slices were obtained from the middle third of the root, three different standard cavities were opened to each root slice, and the tested materials were applied. The bond strength of the three materials was similar, and cohesive-type failure was reported in most of the samples [21].

Another recent study evaluated the effect of the different adhesion methods for Biodentine and BIOfactor MTA using the dentin micro shear bond strength test. The bond strength value of Biodentine was found to be significantly higher than that of the MTA. BIOfactor MTA had a higher cohesive-type failure rate compared to Biodentine, regardless of the interface materials applied [22]. In this study, the fewest adhesive-type failures were observed in the MTA groups at the bonding interfaces examined with a stereomicroscope. This confirmed that, after a long period, the bond strength of the MTA material increased, and consequently it was more difficult to separate from the root

dentin [23]. The prepared samples were kept in an environment moistened with PBS for 1 week, and it is known that calcium silicate–based materials interact with teeth by forming label-like structures in the presence of PBS [24,25]. The results obtained in our study are in alignment with the literature. In Angelus and BIOfactor MTA groups, 20% adhesive-type fractures, 40% cohesive-type fractures, and 40% mixed-type fractures were observed. It is possible to say that MTA Angelus and BIOfactor MTA materials, which do not have a statistically significant difference in bond strength values, are similar in terms of bonding quality to root dentin. In the AH Plus group, 10% adhesive-type failure was observed, the lowest adhesive-type failure rate.

The apical plug application part of this study was planned according to the study by Hachmeister et al. in which they emphasized the effect of MTA placement techniques [26]. In addition, preparation steps and MTA plug thickness were applied according to the in vitro model suggested by DeAngelis et al. [27]. The sealing efficiency of endodontic repair materials has been evaluated using different techniques: leakage tests, SEM analyses, and radiographic evaluations. These methods have some disadvantages, such as being insufficient to examine the filling quality in detail or having preparation steps that damage the samples [28]. For these reasons, a micro-CT advanced imaging technique, which provides three-dimensional imaging and enables precise measurements, such as surface area and void volume, was used for the microleakage evaluation [29,30].

Regarding the MTA placement technique, hand condensation, the traditional method, has been compared with the ultrasonic activation technique in many studies. Researchers have reported that indirect ultrasonic activation is a more suitable method for mimicking clinical situations than direct ultrasonic activation and hand condensation [5–7,31,32].

In this study, when the groups were compared in general in terms of placement techniques, the percentages of external voids of the Angelus and BIOfactor groups in which MTAs were placed by hand condensation were found to be statistically significantly higher than the Angelus and BIOfactor groups in which MTAs were placed by indirect ultrasonic activation. When evaluated in terms of porous spaces, there was no statistical difference between the groups according to the placement technique. When MTAs were placed with indirect ultrasonic activation, there may be fewer external voids observable because of the better flow on the root canal wall and better adhesion. Thus, the data we obtained in this study support the literature.

As a secondary result, when Angelus and BIOfactor MTA groups with the same placement technique were compared, no statistical difference was found between placement by manual densification or indirect ultrasonic activation. When MTA Angelus and BIOfactor MTA were compared, the lack of a significant difference in gap percentages, dentin wall compatibility, and homogeneity values can be attributed to similar homogeneity and the presence of particles of similar size and shape.

Yeung et al. applied MTA on acrylic blocks by manual densification and indirect ultrasonic activation for 1 second [31]. In the groups in which MTA was placed using indirect ultrasonic activation, less porosity was found even in curved canals. According to the results of the study by Kim et al. an MTA apical plug had significantly less resistance to bacterial leakage when hand condensation was performed [32]. In addition, Lawley et al. examined the MTA apical plugs placed using different techniques with the bacterial leakage test and reported that ultrasonics could be used to increase the efficiency of the MTA placement technique and the flow of MTA [7]. They observed that the MTAs placed with indirect ultrasonic activation had less porosity radiographically. This information aligns with the findings of our study in terms of placement technique. On the other hand, Aminoshariae et al. applied different thicknesses of MTA plugs, examined both with light microscopy and radiography, and reported that it showed better adaptation when applied with hand condensation [6]. Although there is no clear information about the duration of ultrasonic activation in this study, the direct application of ultrasonic energy to MTA may have led to uncontrolled condensation and more hollow fillings. In addition, it is known that both examination techniques used are less than adequate for examining the internal structure of a material.

El-Ma'aita et al. who used micro-CT after placing MTA with hand condensation and indirect ultrasonic activation, found less porosity in hand condensation. They also reported that the voids decreased when they prolonged the ultrasonic activation time [5]. However, these results were different from previous studies and our own. Although we produced 4 mm MTA apical plugs, El-Ma'aita et al. filled the entire 15 mm long canal space with MTA and delivered ultrasonic energy to each layer, which may have resulted in excessive energy transfer to the MTA, degradation of the material, and poorer adaptation. From the

information provided, we think that indirect ultrasonic energy may have caused the distribution of heterogeneous particles of MTA, resulting in a more compact apical plug compared to the manual condensation technique.

Sisli and Özbaş evaluated the leakage of ProRoot and MTA Angelus apical plugs by manual condensation and indirect ultrasonic activation with micro-CT and found that the porosity values between dentin walls and apical plugs were significantly higher in MTA Angelus groups than in ProRoot MTA groups [13]. In the same study, it was found that ProRoot MTA provided higher adaptation than MTA Angelus when placed using hand condensation. However, when placed using indirect ultrasonic activation, they were found to be statistically similar in terms of the dentinal wall and the mean space between them. In our study, the mean gap between the dentin wall and MTA in the hand condensation group was 6.383% for MTA Angelus and 6.828% for BIOfactor MTA, also statistically similar. Likewise, while the mean space between the dentin wall and MTA was 3.165% in the group where MTA Angelus was placed with indirect ultrasonic activation and 2,836% in the group in which BIOfactor MTA was used, also statistically similar.

There is no study in the literature evaluating the microleakage of BIOfactor MTA. This study is a pioneering assessment of this topic. Therefore, further studies are needed to compare the results.

Limitations

One of the limitations of this study is that the total number of test samples for Micro- CT analysis (n = 72) was a small sample size. Another limitation is that the consistency of injectable BIOfactor MTA cannot be standardised.

CONCLUSIONS

Within the limitations of this in vitro study, AH Plus, MTA Angelus, and BIOfactor MTA materials showed similar results in terms of their dentin bond strength and fracture types, and adhesive-type fracture was minimal in all groups, with the lowest rate found in the AH Plus samples. BIOfactor MTA showed similar results to MTA Angelus in terms of adaptation to dentinal walls, regardless of placement technique. It is thought that this result might be related to similar particle sizes and homogeneity. When MTA Angelus and BIOfactor MTA were placed using indirect ultrasonic activation, the porosity rates were found to be lower than when using hand condensation. Further studies are needed to evaluate the effects of using micro-CT on clinical outcomes to determine whether the sealing efficiency and porosity of the MTA apical plug applied for apexification inpatient treatments can be increased by indirect ultrasonic activation. Although our study with BIOfactor MTA, a newly developed material, has given successful results, further studies on other properties of the material such as biochemical and physical properties are required.

Conflict of interest: The authors deny any conflicts of interest related to this study.

Informed Consent: This study was an in-vitro study, so an informed consent form not be added.

Funding: This study was supported by the Scientific Research Projects Coordination Center of Selçuk University (project no. 17102047).

Ethical Approval: Ethical approval was obtained from Selçuk University Clinical Research Ethics Committee (2017-09/14).

Author Contributions: Conception: MS,B;T,TK - Design: MS,B;T,TK - Supervision: MS,B; T,TK -Materials: T,TK - Data Collection and/or Processing: T,TK - Analysis and/or Interpretation: MS,B;T,TK - Literature: T,TK - Review: MS,B;T,TK - Writing: T,TK - Critical Review: MS,B;T,TK .

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How to Cite;

Kaplan TT, Botsalı MT (2024). Micro-Computed Tomographic Evaluation of the Sealing Quality and Bond Strength of Different MTA Apical Plugs. Eur J Ther. 30(1):29-38. https://doi.org/10.58600/eurjther1919

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):39-47.
https://doi.org/10.58600/eurjther1936

Original Research

The Accuracy of Different Apex Locator Systems in Detecting Root Perforations in the Presence of Different Irrigation Solutions

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Received: 2023-11-21 **Accepted**: 2023-12-18 **Published Online**: 2023-12-18

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ABSTRACT

Objective: One of the most studied topics in electronic apex locators (EALs) is the effect of root canal condition on the accuracy of EALs. In this study, the accuracy of Root ZX Mini, Raypex 6, and Apex ID in detecting root perforation was evaluated in a dry environment and in the presence of saline, ethylenediamine tetraacetic acid (EDTA), and sodium hypochlorite (NaOCl) solutions.

Methods: The mesiobuccal roots of 64 human maxillary first molars were selected for the study. These root canals were perforated from buccal root surface using a #1 Freze Beutherlock Peeso to form a 0.4 mm cavity. After perforation, the area where #40 K type file appeared was recorded as the actual length (AL) and the length measured by EAL devices both in dry canals and in the presence of solutions was recorded as the electronic measurement (EL). All electronic measurements were statistically compared with the actual length.

Results: All EALs achieved AL-consistent results on EL measures. Consistency was determined using Root ZX Mini measurements in dry canals and canals irrigated with saline. The consistency of EL and AL conducted with Raypex 6 and Apex ID in canals irrigated with NaOCl, saline, and EDTA was found. There was a statistically significant difference in ELs with irrigation solutions among all EALs ($p<0.05$). In the dry environment, there was no statistically significant difference between the EALs ($p>0.05$). A consistency was discovered between ELs generated with the Root ZX Mini and ALs in both dry and saline-irrigated canals. Consistency was observed between ELs measured with Raypex 6 and Apex ID and ALs in canals irrigated with NaOCl, saline, and EDTA.

Conclusion: The accuracy rates of the EALs used in this research were 97%–100% in the 1 mm range and 83%–92% in the 0.5 mm range. Despite the fact that ALs and ELs differed statistically significantly at the 0.05 level, these variations weren't thought to be clinically relevant. In the presence of conditions with different electro conductors, EALs from different generations may be used safely, and in a range of canal situations, these devices can yield measurements that are most similar to the AL.

Keywords: Apex locator, Apex ID, Electro conductivity, Raypex 6, Root ZX.

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INTRODUCTION

Root perforations are pathological connections that relate the root canal system to the exterior of the root and adjacent tissues by damaging the cementum tissue [1]. Perforations can be caused by deep caries or pathological apical conditions, although the majority of them are iatrogenically developed [2]. Root perforation is a significant problem occurring in 3-10% of endodontic procedures [3]. These inadvertent conditions may cause irritation and contamination of irrigation solutions or sealers, as well as debris created during endodontic treatment in connection to the afflicted area [4, 5]. Furthermore, inaccurate detection of the perforated region raises the possibility of procedural mistakes such as overinstrumentation and overfilling. When treating the perforated site, the time elapsed between perforation and treatment, as well as the size and location of the cavity, are critical. The prognosis is poor if the condition is not adequately assessed and treated, which could require tooth extraction [1]. It is critical to understand the location of the perforation so that root canal preparation, intracanal medicament administration, and perforation repair may be carried out correctly. Dental operation microscopy, endoscopy, optic coherence tomography, profuse bleeding from the root canal during instrumentation, examination of bleeding by paper points, and radiographic assessment are all possible methods for locating root perforations [5 - 7]. These approaches, however, have obstacles in practical applications. For example, in the presence of blood in the perforation area, a paper point may not always be able to identify the perforation zone. Furthermore, when perforation is in the buccal or palatal sides of the root, traditional radiographs have limited diagnostic value in some cases, such as overlapping anatomical structures, and radiopaque materials [8]. D'Addazio et al. spotted this pattern and reported that periapical radiography failed to identify the majority of perforations, resulting in inaccurate diagnosis in 20% of instances [9].

Main Points;

- It has been found that Root ZX Mini, Raypex 6, and Apex ID can be used safely for detecting root perforation, in a dry environment and in the presence of saline, EDTA, and NaOCl solutions.
- With this study to examine the accuracy of EALs with different root canal solutions, although there were differences between irrigated canal groups, there was no difference in a dry environment.

Electronic apex locator (EAL) is a non-invasive option supplementary to radiography for more precisely detecting the location of root resorptions [6]. According to Sunada's research, there is a continuous association between the electrical resistance of the oral mucous membrane and the periodontium; an EAL may assess perforation when it connects with the periodontal membrane and records a constant value [10]. Previous EALs were not particularly accurate in the presence of irrigation solutions because they work on resistance measurements between the root canal and the periodontal ligament (PDL) [11]. The most recent generation of EALs can detect impedances at numerous frequencies and function in both dry and wet canal environments [12]. The Root ZX Mini (J. Morita Corp., Tokyo, Japan) is a third generation EAL with a tiny, portable design that employs a proportional technique created by adapting the Root ZX [13]. Raypex 6 (VDW GmbH, Munich, Germany) is a multi-frequency EAL that is the fourth generation member of the Raypex series [7]. Apex ID (SybronEndo, Glendora, CA) is also a fourth generation EAL that works in the same way as Root ZX but at altered frequencies [14].

The importance of root canal irrigation during endodontic procedures cannot be overestimated. Endodontic irrigants widely employed for this purpose include sodium chloride solution (saline), ethylenediamine tetraacetic acid (EDTA), and sodium hypochlorite (NaOCl) [15]. Several investigations have found that irrigant in the root canal can impair EAL accuracy [7, 16].
The purpose of this study is to compare the detection accuracy of the Root ZX Mini, Raypex 6, and Apex ID under dry conditions and in the presence of 0.9% sterile saline, 5% NaOCl, and 17% EDTA. The null hypothesis was that there was no difference in the efficacy of the three EALs in finding root perforations under four separate canal conditions.

MATERIALS AND METHODS

The University Clinical Researches Ethics Committee authorized the research design (Approval number: 2017/369, date: 06.11.2017). All experimental procedures were carried out in matching with the World Medical Association Declaration of Helsinki, and all participants provided written informed consent. Using G*Power 3.9.1 software (Heinrich Heine University, Dusseldorf, Germany) and a previous study [15], a power calculation was performed to determine whether the expectation of a medium effect size (f=0.25) between measurements made with EALs in four different environments (dry condition-NaOCl-saline-EDTA) was statistically significant. The minimum number

required in each category was 45 (α= 0.05; 1-β=0.80). A sample size of 64 teeth was selected for this study. The same samples were used for each irrigation solution and each EAL in all groups in order to ensure standardization in applications.

Sample Preparation

The study included 64 human maxillary first molar teeth extracted for orthodontic or periodontal reasons excluding teeth with root fractures, open apices, calcification, prior root perforations, and root resorption. To provide a consistent reference point for all measurements and to ensure a 15 mm root length, the mesiobuccal roots of these teeth were split with diamond burs (Diatech, Charleston, USA) under water cooling. A periodontal curette (Gracey curettes, Hu-Friedy, Chicago, USA) was utilized to remove calculus from the root surfaces. A stereomicroscope (Carl Zeiss, Gottingen, Germany) was employed to extensively examine the root at 20° mesial and distal angulation (OB Ç). Then the roots were disinfected for 48 hours at 4 °C in 5.25% NaOCl solution (Wizard, Rehber Kimya, Istanbul, Türkiye) and kept in 0.9% sterile saline solution (Polifarma, Istanbul, Türkiye) until use. The working length of each root canal was estimated to be 1 mm shorter than this measurement after the tip of a #15 K-file became observable in the apical foramen of the teeth (OB Ç). The canals were then instrumented with Reciproc (VDW, Munich, Germany) rotary instruments #25 and #40. During the instrumentation, 2.5 mL of 5.25% NaOCl (Wizard, Rehber Kimya, Istanbul, Türkiye) was administered to irrigate the canal, followed by 2.5 mL of distilled water. The canals were irrigated with 2 ml of 5.25% NaOCl followed by 2 ml of distilled water and dried with paper points (DiaDent Group, Chongju, Korea) after preparation.

Using a NSK F16R handpiece (NSK, Tochigi, Japan) and a #1 Freze Beutherlock Peeso (Mani Inc. Japan), the roots were artificially drilled towards the outside of the buccal root surface at a 90-degree angle. This point was at 4 mm from the anatomical apex and also at the outermost point of the root curvature. The cavities were approximately 0.4 mm in diameter. An electronic caliper (Mitutoya, Kawasaki, Japan) was used to measure the diameter of the artificial perforations. A #40 K-file was inserted and seen via the perforation site with a stereomicroscope (Carl Zeiss, Gottingen, Germany) at 4X magnification. The actual length (AL) of the canals up to the perforation area were measured to the nearest 0.05 mm with an electronic caliper by visualizing the tip of a #40 K type file at 20X magnification under the stereomicroscope (Figure 1). AL measurements were performed by two operators (OB Ç, E Ç) with ten years of expertise with EALs using various technologies, and the results were averaged to assure the accuracy of the measurements.

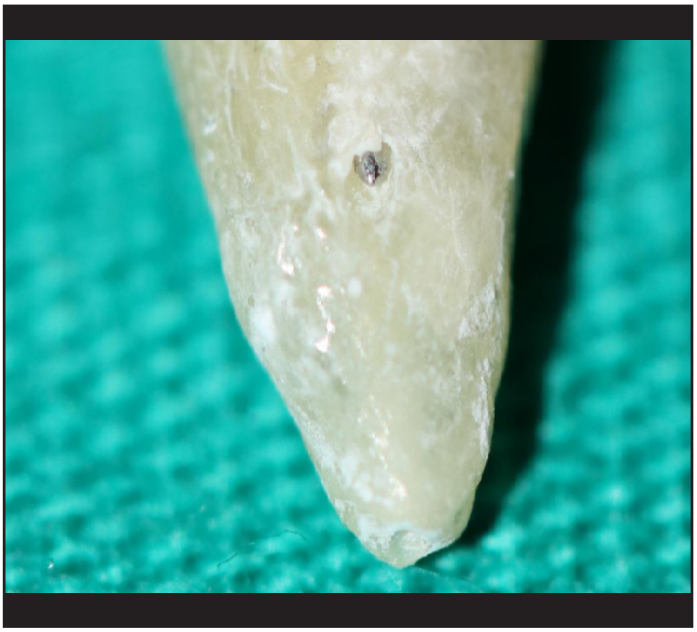

Figure 1. The hand file coming out of the perforated area

Alginate (Blueprint, Dentsply, UK) was poured into 20 mm deep silicone cylinder molds. The teeth were then inserted in this mold up to the cemento-enamel junction in order to simulate the PDL. To finish the electrical connection, a slot was cut on the edge of the alginate model for putting the lip clip. Apex locators were then employed in dry canal conditions and in irrigated conditions with 5.25% NaOCl (Wizard, Rehber Kimya, Istanbul, Türkiye), 0.9% sterile saline solution (Polifarma, Istanbul, Türkiye), and 17% EDTA (Werax, Izmir, Türkiye) respectively to digitally detect the perforation site using a #40 K type file. Two blinded evaluators (OB Ç, E Ç) examined the Root ZX Mini, Apex ID, and Raypex 6 readings in line with the manufacturers' electronic measuring (EL) instructions. Each EAL's EL measurements were also repeated twice, and their averages were recorded. The difference between the ELs and the AL of the perforations was also estimated by subtracting AL from EL. Negative and positive values indicated that measurements taken by EALs were short or long of the AL, respectively. As an intermediate irrigant, 2.5 ml of distilled water was utilized between each irrigant with a double side-port needle (31 gauge NaviTip Sideport; Ultradent Products Inc, South Jordan, UT, USA). The canals were then dried with paper points. This method was then repeated with different irrigant solutions introduced into the root canal before inserting the #40 K-file to locate the perforation site.

Statistical Analysis

The information was recorded using a computer software (Microsoft Office Excel 2010, USA) and double-checked for accuracy. The descriptive statistics for the study's data were mean and standard deviation (SD) for numerical variables. The Shaphiro Wilk test determined whether the data was suitable for normal distribution, and the paired t test compared the values of normally distributed variables across two techniques. Furthermore, intraclass correlation coefficients were calculated to assess measurement agreement between EALs. The difference between the measurements obtained in different EALs and settings and the real measurement was analyzed using analysis of variance. The Tukey test was employed to distinguish across experiment groups. SPSS 22.0 (SPSS Inc, Chicago, IL, USA) was used to conduct the analyses and tests. The significance level of $p<0.05$ was selected.

RESULTS

Table 1 shows the mean differences in perforation measures between EL and AL for the EALs employed in the study under varied canal circumstances, as well as the consistency between EL and AL. The study hypothesis was accepted because within the 95% confidence interval (p=0.001), all EALs in the study achieved AL-consistent results on EL measures. Table 2 presents the mean ELs and SDs of recorded from the EALs tested in the study under four separate canal conditions.

Consistency was determined using Root ZX Mini measurements in dry canals and canals irrigated with saline when the relationship between ALs and ELs was examined at the 0.05 significance level. The consistency of EL and AL conducted with Raypex 6 and Apex ID in canals irrigated with NaOCl, saline, and EDTA was also found (Table 1). In different root canal situations, there was a statistically significant difference in the ELs of the Root ZX Mini, Raypex 6, and Apex ID ($p<0.05$) (Table 1). However, in the dry environment, there was no statistically significant difference between the EALs ($p>0.05$). Furthermore, there was no statistically significant difference in EALs when NaOCl, saline, or EDTA were present ($p>0.05$). Table 1 also displays the EALs-canal conditions groups with 0.05 significant levels between ALs and ELs. A consistency was discovered between ELs generated with the Root ZX Mini and ALs in both dry and saline-irrigated canals. Consistency was also discovered between ELs created with Raypex 6 and Apex ID and ALs in canals irrigated with NaOCl, saline, and EDTA.

Root ZX Mini measurements in dry, NaOCl, EDTA, and saline were 83%, 88%, 89%, and 90% within the range of 0.5 mm, respectively. 97%, 100%, 97%, 100% success rates were recorded in the 1 mm range. Raypex 6 readings in dry, NaOCl, EDTA, and saline were 84%, 92%, 86%, and 90% within the range of 0.5 mm, respectively. 98%, 100%, 100%, and 100% success rates were recorded in the 1 mm range. Apex ID measurements in dry environment, NaOCl, EDTA, and saline were 89%, 92%, 86%, and 92% within the range of 0.5 mm, respectively. It was discovered to be 100% effective in all situations in the range of 1 mm.

Table 1. The mean difference between electronic lengths and actual length of the perforation with standard deviation for each electronic apex locator in different canal conditions (mm)

	Mean ± Standard Deviation				P value
	Dry condition	**NaOCl**	**Saline**	**EDTA**	
Root ZX Mini	0.12 ± 0.39^{a}	0.01 ± 0.3^{Bb}	-0.14 ± 0.3^{Bc}	-0.12 ± 0.38^{Bc}	0.001*
Raypex 6	0.07 ± 0.33^{c}	0.21 ± 0.29^{Ab}	0.31 ± 0.27^{Aa}	0.4 ± 0.34^{Aa}	0.001*
Apex ID	0.04 ± 0.31^{a}	-0.14 ± 0.3^{Cb}	-0.13 ± 0.27^{Bb}	-0.27 ± 0.33^{Cc}	0.001*
P value	0.460	0.001*	0.001*	0.001*	

*p<0.05; Analysis of Variance, Tukey posthoc test

A, B, C: Different superscript uppercase letters in the same column indicate statistically significant differences between electronic apex locators in the same environment.

a,b,c: Different superscript lowercase letters in the same row indicate statistically significant differences between environments in the same electronic apex locator.

SD, standard deviation

Saline, sterile sodium chloride solution

NaOCl, sodium hypochlorite

EDTA, ethylenediamine tetraacetic acid

Table 2. Mean and standard deviation values of electronic lengths measured with each electronic apex locators in different canal conditions (mm)

	Mean ± standard deviation			
	Dry condition	**NaOCl**	**Saline**	**EDTA**
Root ZX Mini	8.09±1.87	8.20±1.91	8.35±1.91	8.33±1.92
Raypex 6	8.14±1.89	8.00±1.89	7.90±1.90	7.82±2.06
Apex ID	8.17±1.92	8.35±1.94	8.34±1.93	8.48±1.97
Actual length	8.21±2.00			

Saline, sterile sodium chloride solution
NaOCl, sodium hypochlorite
EDTA, ethylenediaminetetraacetic acid

DISCUSSION

Root canal perforation may jeopardize periradicular tissue health and tooth retention. Radiographs can detect these tooth perforation sites. However, root perforations at the buccal or lingual side of the root surface are difficult to identify with 2-dimensional radiography methods [17], even for well-trained endodontists. Although attempts are made to overcome the shortcomings of 2D imaging, such as detecting dilacerations in the buccolingual direction with intraoral radiographs, cone-beam computed tomography (CBCT) is a more reliable 3-dimensional imaging approach for identifying perforation than periapical radiography, which eliminates these drawbacks [9, 18]. On the other hand, the radiation dosage produced by CBCTs precludes their widespread usage [19].

EALs, which have no side effects on tissue integrity, have been reported as a very accurate means of finding root perforation [5, 6]. In theory, in vitro models used to assess the accuracy of EALs have the problem of not fully reflecting in vivo research [20]. In reality, however, there is no statistical difference between research assessing EAL accuracy in vivo and in vitro circumstances, suggesting that in vitro models have produced solid results [21]. To imitate the electrical resistance of PDL, the mounting material must be similar to that of periodontal tissue. In in vitro studies of EALs on perforated roots, multiple dental embedding media such as agar, gelatin, sponge, alginate, and saline solution imitate the clinical situation [5, 6, 11, 22 - 24]. However, in ex vivo research, alginate revealed better results than other materials regarding EAL accuracy [24]. Alginate was preferred in the present study because it is an excellent electroconductive medium that remains around the tooth due to its colloidal gel form and mimics the periodontal situation [16]. In addition to these benefits, it is simple to handle and cheap [5, 25]. The alginate's solid consistency limits tooth movement and potential material penetration into the imitation perforation [24]. Furthermore, alginate endures around the root, preventing the operator from seeing the file tip, and thus offering reliable EL measurements [5, 24].

Although cavities with diameters ranging from 0.25 mm to 1.25 mm were recorded using EALs in earlier research [3, 6, 11, 26, 27], Shin et al claimed that artificial cavities wider than 1 mm could not properly imitate clinical root resorption situations [11]. Koç et al. found that EALs were successful in detecting artificial root cavities with sizes of 0.75 mm or more [28]. Similar to this study, several other investigations have indicated that the cavities with a diameter of less than 0.4 mm are ideal for EL measurements [11, 27, 29]. We considered the possibility that a greater cavity diameter may have an impact on the EALs' measurement accuracy and utilized larger cavities. EALs have been demonstrated to be accurate in identifying 1.5 mm perforations that may occur externally on the root surface as a result of post-placement intracanal treatments, resorption, and the use of larger files or coronal shapers. [30].

Previous investigations on the accuracy of Root ZX Mini, Raypex 6, and Apex ID in varied canal conditions revealed inconsistent findings. Furthermore, there was no agreement in the literature on the impact of varied canal conditions on the accuracy of Root ZX Mini and Root ZX, which is the original model of Root ZX Mini. Unlike Shin et al. and Srivastava et al., we observed that EL identified with Root ZX Mini in the presence of saline in the canal was consistent with AL [11, 29]. Similarly, Kaufman et al reported that in the presence of saline, the Root ZX Mini was more accurate in assessing working length of the canal [30].

Our findings, which were consistent with previous research, demonstrated that the presence of NaOCl in the canal influenced the EL detection of perforations by Root ZX Mini [11, 31]. This observation contradicted the findings of Bilaiya et al and Aydin et al [16, 32]. Shabahang et al showed that in the presence of NaOCl, the biggest divergence from AL in the measurements of Root ZX in the identification of the apical foramen occurred with NaOCl [33]. Several studies, on the other hand, concluded that NaOCl did not influence the ELs of Root ZX [34, 35]. In contrast to the research of Bilaiya et al and Aydin et al, the accuracy of the Root ZX Mini had been compromised in the current study [16, 32]. In our investigation, neither Raypex 6 nor Apex ID were able to measure the EL of perforations as well as Root ZX Mini in dry canal settings [31]. Also, ELs measured with the Root ZX Mini were greater in dry root canals than in irrigated root canals, comparable to the findings of Srivastava et al [31]. As noted by Bilaiya et al., the explanation for this circumstance could be that these EL measurement values were insufficient to have an impact on RootZX Mini's measuring performance [16]. However, other research also found that ELs were less reliable and unstable in dry canal environments because of Root ZX's reduced conductivity [29, 34]. Unlike the study conducted by Aydin et al., our current research's Raypex 6 results were impacted by dry circumstances but not by NaOCl or EDTA [32]. Comparisons were challenging since there was limited research on Apex ID's EL perforation measuring performance. Nonetheless, in 95% of the cases in which Koç et al. used saline to identify cavities with a diameter of 1.25 mm using Apex ID, the difference between EL and AL was between 0.0 and 0.50 mm [28]. This EL was determined to be 92% effective within a 0.5 mm range in the current investigation. The electroconductive qualities of the EALs we employed in our study under various canal circumstances most likely account for the discrepancies in the findings of their EL measurements. The capacity to conduct electricity is known as electrical conductivity, and it is based on the amount of dissolved ions present. Because of this, the aforementioned characteristic is exclusive to endodontic irrigation solutions and is also influenced by temperature and chemical composition. Differences in electrical conductivity within irrigating solutions influence not only the working length but also the EL of perforations [5, 11, 20]. The shape of the apical foramen may be one explanation for these inconsistencies. EL measurement performance of EAL might be affected by the structure and position of the main foramen [36]. Another explanation might be related to the principles on which these devices use, methodological variances, and operator competence [7, 13]. To ensure standardization, two endodontists with expertise in three distinct EALs with various technologies assessed the ELs in an alginate mounting model that allows for more exact measurements [6]. Also, we chose Raypex 6 and Apex ID which are fourth generation EAL in our study. The first reason was to compare the EL measurement performances of the perforation cavity between the same generation EAL using different frequencies. Secondly, there were few studies on EL determination of Apex ID.

The findings of this study, matching the literature, indicated that all three EALs were within the acceptable range. When analyzing the accuracy and repeatability of EAL measurements, literature noticed that SD was more essential than the difference between AL and EL, and that low SD suggested consistency of EALs [6, 35, 37]. The findings of research assessing the accuracy of perforation measurements of EALs were classified into acceptable error range tolerances of 0.5 or 1 mm [6, 11, 32]. In this research, the EL measurement in the dry environment of the Root ZX Mini had the lowest success rate (83%) in the 0.5 mm tolerance range, whereas the EL measurement of Raypex 6 in the presence of NaOCl and Apex ID in the presence of NaOCl and saline had the greatest success rate (92%). The EL readings of the Root ZX Mini in a dry environment and EDTA had the lowest success rate (97%) within the tolerance range of 1mm. Apex ID EL readings were 100% successful in all conditions, Raypex 6 in all irrigation solutions except dry, and Root ZX in NaOCl and saline. The lowest mean difference between EL and AL (0.01± 0.3) was measured in Root ZX Mini in the presence of NaOCl, and the greatest mean difference (0.4 ±0.34) was observed in Raypex 6 in the presence of EDTA. Aydin et al. discovered that the average distance from the tip of the file to the root canal perforations for Root ZX Mini was from 0.11 to 0.31 and 0.22 to -0.18 for Raypex 6 [32]. However, in our study, these values ranged from 0.01 to -0.14 and 0.07 to 0.4. The probable explanations for the difference might be that the artificial cavity constructed in their investigation was 1 mm in diameter, and they employed a Qmix solution containing substances with different electrical conductivities rather than saline [32]. Extrapolating these findings to real-life situations, it is possible to conclude that these irrigation solutions are difficult to keep in the perforation region, and the material employed to simulate PDL may not be as resistant as natural PDL. As a result, more in vivo studies are necessary for comparing these findings with other clinical scenarios.

Limitations

Firstly, 1.5 mm cavity diameter used in past studies may not be clinically appropriate since a study reports that perforations of 1 mm and greater may not properly reflect the actual situation (11). Perforation defects bigger than 1.5 mm, on the other hand, are clinically likely for a variety of reasons. Secondly, the conductivity of an irrigation fluid is proportional to its concentration (28). As a result, if we had chosen alternative concentrations in our study, we may have received different results. Thirdly, the fact that the EALs in our in vitro investigation were in contact with alginate impression material rather than real tissues most likely influenced the modeling of clinical situations. Furthermore, the lack of electro-conductive substances in the oral condition, such as blood and saliva, in the experimental setting may have resulted in differing EL values.

CONCLUSIONS

In the current study, the EALs employed exhibited an accuracy rate of 97%-100% in the 1 mm range and 83%-92% in the 0.5 mm range. Although there were statistically significant differences between ALs and ELs, these differences were not assessed as clinically meaningful. EALs of various generations may be used safely in the presence of various electro conductors and root canal irrigation solutions, and measurements closest to the AL can be obtained with these devices in a variety of canal circumstances.

Conflict of interest: None declared.

Funding: None declared.

Informed Consent: Received.

Ethical Approval: The Gaziantep University Clinical Researches Ethics Committee authorized the research design (Approval number: 2017/369, date: 06.11.2017).

Author Contributions: Conception: Ç, OB; A, U - Design: Ç,OB - Supervision: Ç,E; A,U - Fundings: Ç, E; A, U -Materials: Ç,OB - Data Collection and/or Processing: Ç, OB; Ç, E - Analysis and/or Interpretation: Ç, E; A, U - Literature: Ç, E; - Review: Ç, E; A, U - Writing: Ç, E - Critical Review: A, U.

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How to Cite;

Çetinkaya OB, Çulha E, Aydin U (2024). The Accuracy of Different Apex Locator Systems in Detecting Root Perforations in the Presence of Different Irrigation Solutions. Eur J Ther. 30(1):39-47. https://doi.org/10.58600/eurjther1936

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):48-59.
https://doi.org/10.58600/eurjther1680

Original Research

Scientometric Research Analysis of Cleft Lip and Palate Literature: Hot Spots, Most Influential Countries / Journals, History and Future

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Received: 2023-07-01 **Accepted:** 2023-07-23 **Published Online:** 2023-07-27

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ABSTRACT

Objective: Identifying and mapping the hotspots of the Cleft lip and palate (CLP) literature from 1980 to 2022, in addition it is aimed to present the results in a simplification. This article aims to offer an overview of pertinent research, examine prevailing research patterns, and stimulate appropriate areas for future investigation.

Methods: In this scientometric research analysis, CLP publications between 1980 and 2022 were obtained from the Web of Science Core Collection database. The keywords "cleft lip and palate", "cleft lip, "cleft palate" and "oral cleft" were used in the search. CiteSpace, R-Studio (biblioshiny program) and Excel 2016 software were used for visualizations and analysis.

Results: A total of 26,319 articles and 473,074 references were analyzed. The top 3 countries with the most publications were the United States (9,368 publications, 35.59% of the total), the United Kingdom (2,062, 7.83%), and Japan (1,786, 6.78%). After the co-citation clustering analysis, it was seen that the CLP literature was divided under 13 headings. The most influential articles were found with the citation burst analysis.

Conclusion: Scientometric analysis study has been done in CLP's 42-year publication history. The results obtained present the general trend of the CLP literature, the topics on which the literature is divided, and the hot spots. With similar scientometric analysis studies to be carried out in the future, the progress of the literature can be followed and the future can be predicted.

Keywords: Cleft lip, Cleft palate, Scientometric.

INTRODUCTION

Cleft lip and palate (CLP), which is the most common human craniomaxillofacial birth defects, is a complex disease caused by the interaction of environmental and genetic factors [1]. For the treatment of CLP, which has many effects on the affected individual in terms of nutrition, speech, breathing, psychological and social aspects, many treatment types such as surgical intervention, as well as orthodontic treatments, speech therapies, psychological treatments are applied as multi-disciplinary [2].

Due to many reasons such as developing surgical technologies, decreasing costs, increasing experience in this field, and facilitating access to treatment, the number of access and treatment options for CLP patients is increasing day by day. As the number of treatments in this field increases, the number of scientific publications in this field, which develops in accordance with the nature of the development of the scientific process, also increases. Scientific fields have employed diverse statistical analysis methods, including scientometric analysis, to assess the efficacy of journals and articles [3–7]. Furthermore, these

analyses enable the anticipation of the evolutionary trajectory and potential advancements within specific subject domains [8, 9].

There were previous bibliometric analysis studies on CLP [1, 10]journal, authors, first authors, keywords, and citations were extracted and quantitatively analyzed using Bibliographic Item Co-Occurrence Matrix Builder software. The word matrix and co-occurrence matrix were established, and the co-citation analysis, keyword clustering, and social network analysis (SNA. Nevertheless, previous studies lacked a comprehensive assessment through reference and mapping analysis to gauge the extent of contributions made by the analyzed publications to the existing literature. Science mapping and visualization, on the other hand, facilitate the exploration of scientific knowledge [11–14] and give varying results. In this study we compare the accuracies of cluster solutions of a large corpus of 2,153,769 recent articles from the biomedical literature (2004?2008. Specifically, document co-citation analysis enables the identification of pertinent literature, academic communities, and societal influences that might be overlooked in conventional literature review approaches [11].

In this study, identifying and mapping the hotspots of the CLP literature from 1980 to 2022, in addition it is aimed to present the results in a simplification. This article aims to offer an overview of pertinent research, examine prevailing research patterns, and stimulate appropriate areas for future investigation.

MATERIALS AND METHODS

Search Strategies

The search was performed on 04.09.2022 on the Web of Science Core Collection (WoSCC) database to avoid bias due to daily database updates. Search terms (TOPIC = cleft lip and palate) or (TOPIC = cleft lip) or (TOPIC = cleft palate) or (TOPIC = oral cleft) search terms and time 1980-2022 search settings are used, including all document types. Only articles written in English were included in the analysis.

Main Points;

- The United States was the leading country with the highest number of publications and citations.
- CLP literature was divided into 13 clusters.
- ‘Cleft palate’, ‘palate’, ‘cleft lip and palate’, ‘cleft lip’, ‘lip’, ‘children’, ‘orofacial cleft’ were the most used keywords.

Programs and Methods Used in Data Analysis

Data were retrieved from the WoSCC database in “Tab Delimited File” and “Plain Text” formats. The data were processed in Excel 2016 software in order to standardize the writing style of author names, countries, institutes and to make a file ready for analysis in scientometric analysis programs. CiteSpace, R-Studio and Excel 2016 software were used for visualizations and analysis.

Maps are made up of nodes and links. Nodes represented the analyzed item, such as article, author, country, and keyword, depending on the analysis type. Node size in the visualization represents the frequency of citations, whereas the color spectrum ranges from purple to yellow (with increasing yellowness closer to the present), and the outermost pink ring indicates the centrality value of each node. The connecting lines between nodes depict co-occurrence or co-citation relationships, with line thickness denoting the strength of the relationship.

Parameters used in the analysis with Citespace software: time slicing (1980–2022), year per slice (5), term source (entire selection), node type (common-citation/country/keyword/journal), selection criteria (top 50), pruning (Pathfinder) and visualization (Cluster View - Static, Show Merged Network).

Citespace Analysis

Co-citation refers to the frequency at which two documents are cited together by other documents [3, 4]. If two common documents are mentioned in at least one other document, it is said that these documents are co-cited [3, 8].

Cluster analysis is a statistical method used to classify data based on the level of similarity, with the objective of uncovering the distribution of research content pertaining to specific topics [3,4]. In this analysis, in order to determine the cluster titles, the frequency of the words in the titles and abstracts of the articles were taken into consideration and the most frequently used words were assigned as the cluster title. Modularity (Q-score) and Silhouette (S-score) are measures used to assess cluster mapping. A Q-score greater than 0.3 indicates significant constrained associations within the clusters, while an S-score above 0.5 suggests that the cluster is reasonable. An S-score exceeding 0.7 indicates that the cluster is both efficient and persuasive [3, 8].

A burst refers to the frequency fluctuation of a particular type of event. By identifying the references with bursts of citations, important articles in the literature can be identified and an idea of the future path of the literature can be obtained [3, 8, 15].

By analyzing the keywords used in the articles, it was aimed to examine the connection between the publications that make up the literature and to determine the hot spots by performing an burst analysis [3,4].

RESULTS

General Data and Cross-Country Cooperation

A total of 26,319 articles and 473,074 references were included in the analysis. The annual growth rate of the number of publications was 4.32%. The United States (9,368 publications, 35,59% of the total) ranked first in the number of publications, followed by the United Kingdom (2,062, 7.83%), Japan (1,786, 6.78%) and People's Republic of China (1,734, 6.58%). The cooperation map of the countries contributing to the CLP literature is shown in Figure 1 (The purple circles around the nodes and the values written in purple text are the centrality value of that country). A high level of cooperation has been demonstrated with 566 cooperation links between 81 countries.

Journal Analysis

In the journal analysis, the biblioshiny program was used over the R Studio software. In order to determine the most effective journals, the total number of publications, the number of citations and the zone in which they are according to Bradford's

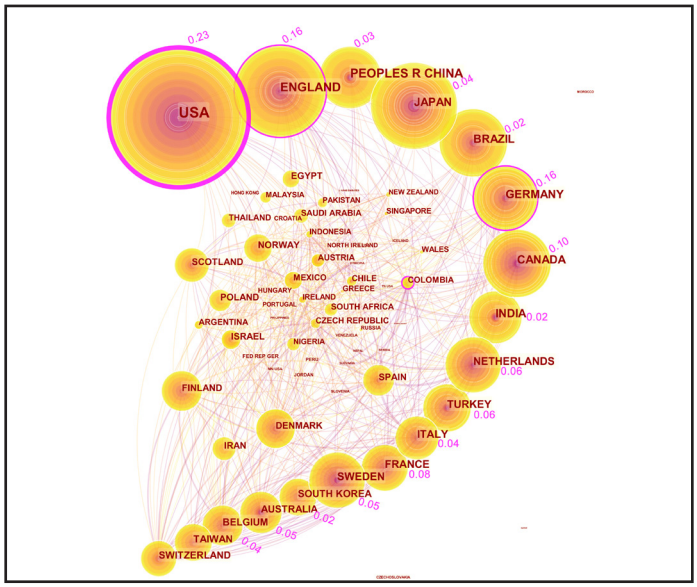

Figure 1. Cooperation network of countries. The outermost pink ring and text represent the centrality value.

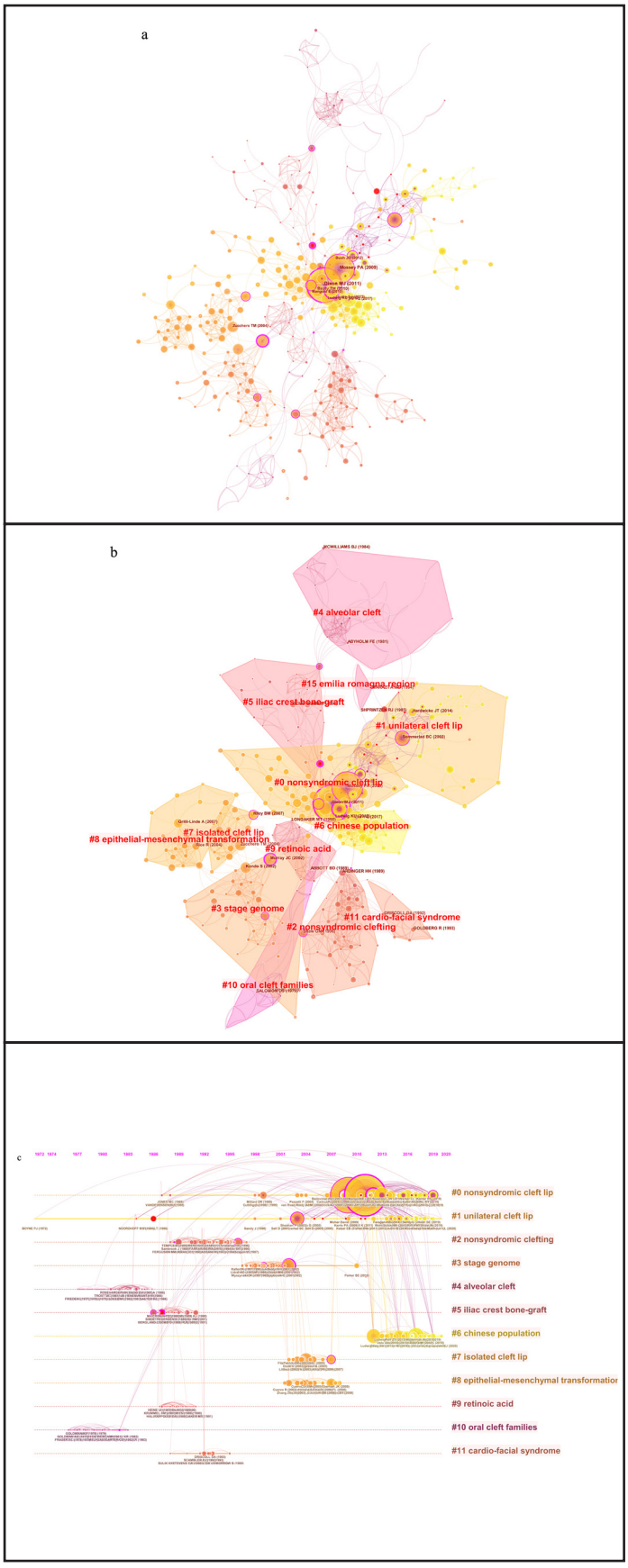

Figure 2. Co-citation analysis. **a.** View before clustering analysis. **b.** View after cluster analysis. **c.** Timeline view

Law of Scattering were determined. According to the results of the journal analysis, Cleft Palate-Craniofacial Journal, Journal of Craniofacial Surgery, and Plastic and Reconstructive Surgery were the top 3 journals with the highest number of publications, while the 20 most influential journals in the field of CLP were summarized in Table 1.

Co-Citation and Cluster Analysis

In the co-citation analysis, the period between 1980 and 2022 was divided into 5-year periods and the 50 most cited articles of the 5-year period were found and analyzed. As a result of the analysis, 439 nodes (reference) and 1,563 connections were revealed (Figure 2a).

The Q-score of the CLP literature was 0.7992 and the S-score was 0.9516. It was seen that the CLP literature was divided into a total of 13 clusters. Information including the metric properties of the clusters in which the CLP literature is divided and the characteristics of the article, which is the main common-reference source, are summarized in Table 2. Figure 2b shows the boundaries of the clusters made on the co-citation analysis map. 3 clusters (Cluster #4-11-15) were separated by clustering in isolation from the others.

The time-line view was used to understand in which years the clusters were more active (Figure 2c). The accumulation of nodes in the Nonsyndromic Cleft Lip (Cluster #0), Unilaeral Cleft Lip (Cluster #1) and Chinese Population (Cluster #6) clusters in recent years indicates that these clusters are younger. CLP terminology has varied over time. When Figure 2c is examined, while the term 'Nonsyndromic clefting' was active until the 1990s, it has evolved into the term 'Nonsyndromic cleft lip' since the late 1990s.

Table 1. Top 20 journals in the field of cleft lip and palate

Rank	Title	Number of Articles	Total Citation	Bradford's Law of Scattering	Impact Factor	Centrality	Quartile
1	Cleft Palate-Craniofacial Journal	3928	61887	Zone 1	1.915	0.77	Q2
2	Journal of Craniofacial Surgery	1390	11669	Zone 1	0.924	0.07	Q2
3	Plastic and Reconstructive Surgery	1245	27445	Zone 1	2.299	0.49	Q1
4	Cleft Palate Journal	641	12919	Zone 1	1.477	0.35	Q3
5	American Journal of Medical Genetics Part A	594	10523	Zone 1	2.249	0.13	Q2
6	Journal of Cranio-Maxillofacial Surgery	439	7316	Zone 1	3.289	0.09	Q1
7	Amerıcan Journal of Medical Genetics	395	13334	Zone 1	2.090 (2004)	0.24	Q2
8	Journal of Oral and Maxillofacial Surgery	375	6413	Zone 1	1.699	0.09	Q1
9	International Journal of Pediatric Otorhinolaryngology	369	4730	Zone 2	1.641	0.10	Q2
10	Journal of Dental Research	365	3403	Zone 2	7.347	0.05	Q1
11	Annals of Plastic Surgery	343	3604	Zone 2	1.425	0.00	Q2
12	International Journal of Oral and Maxillofacial Surgery	274	4715	Zone 2	2.933	0.00	Q1
13	American Journal of Human Genetics	234	9282	Zone 2	9.318	0.14	Q1
14	British Journal of Oral & Maxillofacial Surgery	221	3005	Zone 2	1.597	0.00	Q2
15	Journal of Plastic Reconstructive and Aesthetic Surgery	220	2440	Zone 2	1.550	0.04	Q1
16	Teratology	202	5428	Zone 2	1.689 (2002)	0.32	-
17	American Journal of Orthodontics and Dentofacial Orthopedics	191	4019	Zone 2	1.546	0.13	Q1
18	Birth Defects Research Part A-Clinical and Molecular Teratology	187	6863	Zone 2	2.154 (2018)	0.58	Q2
19	Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery	175	3390	Zone 2	-	0.04	Q4
20	British Journal of Plastic Surgery	163	3199	Zone 2	-	0.00	-

Table 2. After the co-citation analysis, the topics and summary information on which the cleft lip and palate literature is divided are shown. (*Cluster #15 was not included because it was too small and too specific*)

Cluster	Size	Silhouette	Mean (Year)	Main References	Title	Main Conclusion	Quartiles
#0 nonsyndromic cleft lip	66	0.883	2009	Mossey PA, 2012, Front Oral Biol [23]	Epidemiology of oral clefts 2012: an international perspective	In this article, the epidemiological features of CLP have been evaluated.	Q1
#1 unilateral cleft lip	45	0.945	2010	Parwaz MA, 2009, J Plast Reconstr Aesthet Surg [24]	Width of cleft palate and postoperative palatal fistula-do they correlate?	Cleft palate width has been found to have an effect on postoperative palatal fistula formation, with a width of 15 mm or more having a statistically significant risk of fistula formation.	Q1
#2 nonsyndromic clefting	39	0.98	1993	Ardinger HH, 1989, Am J Hum Genet [25]	Association of genetic variation of the transforming growth factor-alpha gene with cleft lip and palate	A significant association was observed between two RFLPs at the transforming-growth-factor-alpha (TGFA) locus and the occurrence of clefting.	Q1
#3 stage genome	37	0.956	1999	Murray JC, 2002, Clin Genet [26]	Gene/environment causes of cleft lip and/or palate	An overview of the gene–environment contributions to nonsyndromic forms of clefting and their implications for developmental biology and clinical counseling is presented.	Q1
#4 alveolar cleft	37	0.965	1983	Abyholm FE, 1981, Scand J Plast Reconstr Surg [27]	Secondary bone grafting of alveolar clefts. A surgical/ orthodontic treatment enabling a non-prosthodontic rehabilitation in cleft lip and palate patients	The basic principles used in primary cleft palate grafting are explained. Stabilizing the mobile primary palate, closure of oronasal fistulas, and grafting before eruption of impacted canines on the cleft side have been suggested.	Q4
#5 iliac crest bone-graft	30	0.968	1988	Semb G, 1991, Cleft Palate Craniofac J [28]	A Study of Facial Growth in Patients with Bilateral Cleft Lip and Palate Treated by the Oslo CLP Team	Various treatment modalities used in CLP patients are described.	Q2
#6 chinese population	30	0.964	2016	Yu Y, 2017, Nat Commun [29]	Genome-wide analyses of non-syndromic cleft lip with palate identify 14 novel loci and genetic heterogeneity	For non-syndromic cleft palate, 41 SNPs were identified in 26 loci, 14 of which were novel (RAD54B, TMEM19, KRT18, WNT9B, GSC/DICER1, PTCH1, RPS26, OFCC1/ TFAP2A, TAF1B, FGF10, MSX1, LINC00640, FGFR1 and SPRY1), providing genome-wide significance.	Q1
#7 isolated cleft lip	20	0.972	2004	Zucchero, 2004, N Engl J Med [30]	Interferon regulatory factor 6 (IRF6) gene variants and the risk of isolated cleft lip or palate	DNA-sequence variants associated with interferon regulatory factor 6 (IRF6) are major contributors to cleft lip, with or without cleft palate. The contribution of variants in single genes to cleft lip or palate is an important consideration in genetic counseling.	Q1

#8 epithelial-mesenchymal transformation	20	0.967	2005	Gritli-Linde, 2006, Dev Biol [31]	Molecular control of secondary palate development	This review highlights the current understanding of the molecular and cellular mechanisms involved in normal and abnormal palate development with special respect to recent advances derived from studies of mouse models.	Q1
#9 retinoic acid	16	0.967	1988	Longaker, 1990, J Pediatr Surg [32]	Studies in fetal wound healing VI. Second and early third trimester fetal wounds demonstrate rapid collagen deposition without scar formation	It has been reported that collagen accumulates much more rapidly in fetal wounds than in adult wounds. Wound collagen deposition occurred in a normal dermal and mesenchymal pattern in second and early third trimester fetal lambs. These findings are consistent with the observation that the fetus heals rapidly and without scarring. In contrast, wounds in late pregnancy fetal lambs showed some evidence of scarring.	Q1
#10 oral cleft families	16	0.992	1979	Tyan, 1978, Proc Soc Exp Biol Med [33]	Genetic and environmental factors in cortisone induced cleft palate	susceptibility to cleft palate in the mouse appears to be under multigenic control. The evidence suggests that perhaps two factors determining the degree of susceptibility to cortisone induced cleft palate are associated with the major histocompatibility complex (H-2) and certain dietary factors can modulate this susceptibility via a gene(s) which tentatively maps in the region of H-2D.	Q1
#11 cardio-facial syndrome	9	0.998	1992	Goldberg, 1993, Am J Med Genet [34]	Velo-cardio-facial syndrome: a review of 120 patients	The purpose of this report is to update the findings associated with the velo-cardio-facial syndrome, including: deletions of DNA probes specific to the 22qll chromosome region, hypocalcemia, psychiatric findings, vascular and cardiovascular anomalies, constitutional growth delay, and hypothyroidism.	Q2

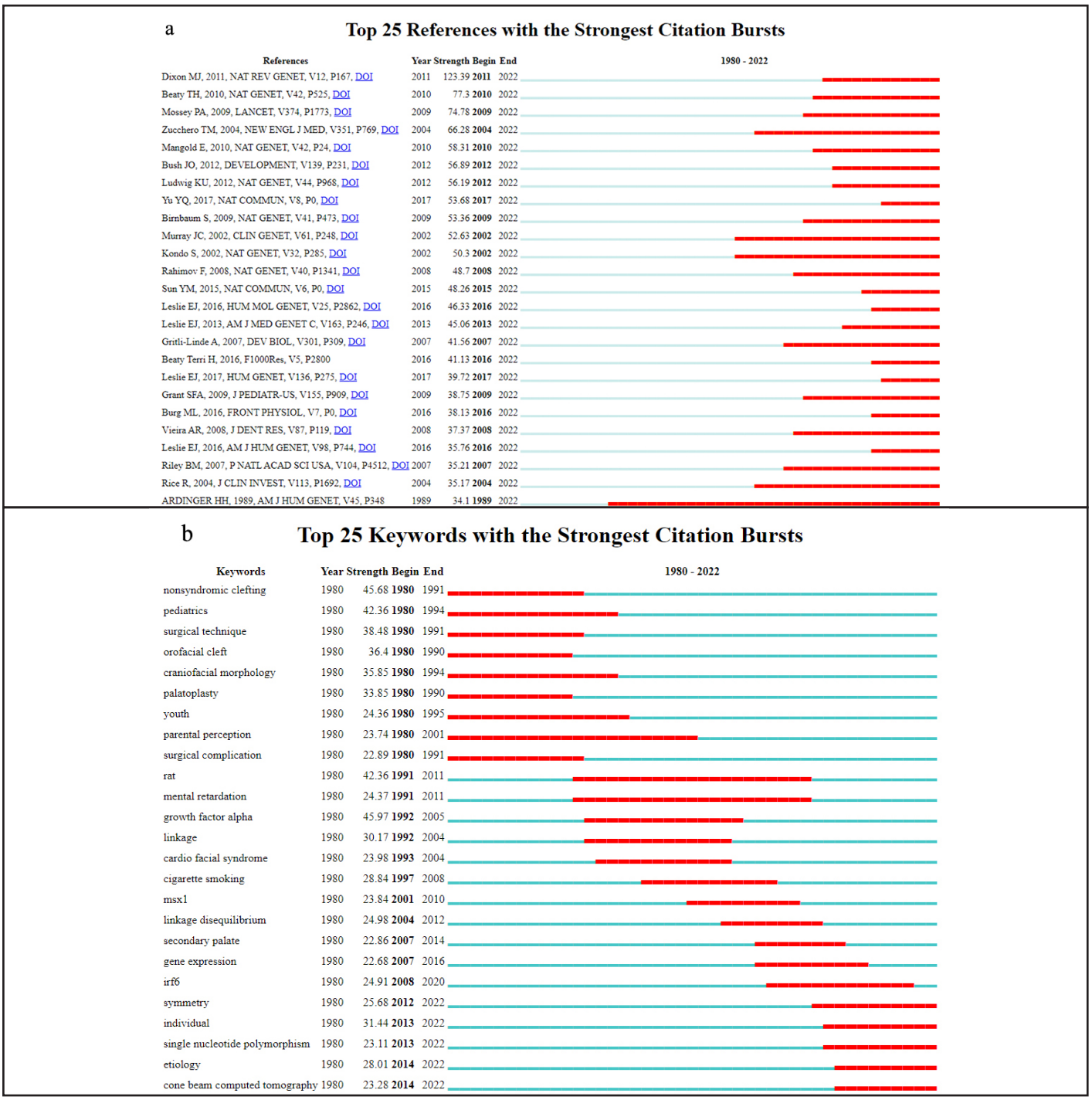

Figure 3. Citation burst analysis. **a.** Top 25 references with the strongest citation bursts. **b.** Top 25 keywords with the strongest citation bursts.

Citation Burst Analysis

In Figure 3a, the 25 articles with the strongest citation explosion in the CLP literature were found and visualized with the Citespace software. In the visualization, the starting point of a blue line represents the publication date of an article. On the other hand, the beginning of a red segment signifies the commencement of a burst period, while the end of the red segment indicates the conclusion of the burst period. Of the 25 references, 22 were on genetics, while 3 were on the epidemiology and etiology of CLP. The burst power of the article titled "*Cleft lip and palate: understanding genetic and environmental influences*" published by Dixon et al.[16] in 2011 was 1.5 times that of its closest competitor.

Keyword Analysis

The network of keywords co-occurrence is shown in Figure 4. 'Cleft palate', 'palate', 'cleft lip and palate', 'cleft lip', 'lip', 'children', 'orofacial cleft' were the most used keywords. The citation burst analysis of the keywords is shown in Figure 3b. In this image, the idea of which sub-headings about CLP attracts the attention of the authors in certain time periods from 1980 to the present is reached.

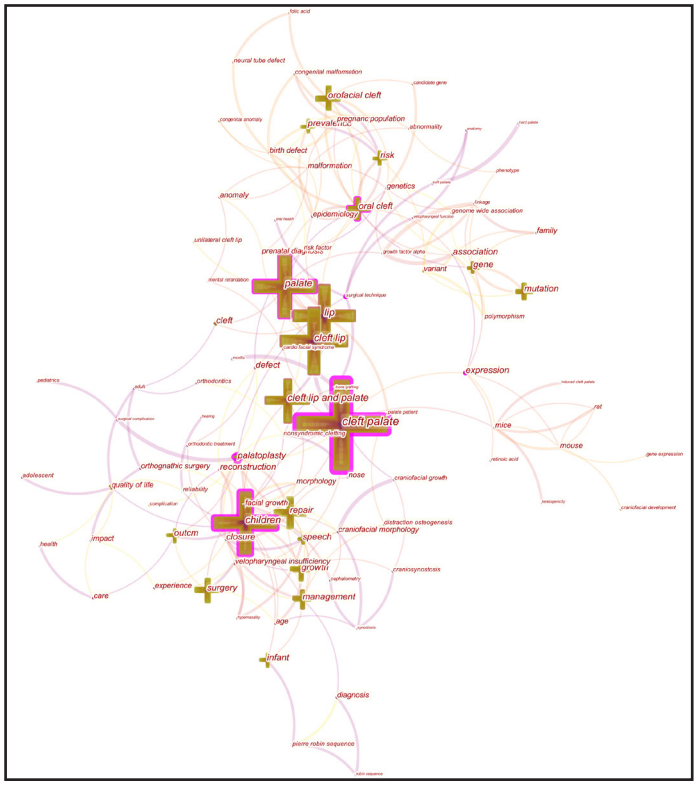

Figure 4. The co-occurrence network of keywords.

DISCUSSION

This scientometric research analysis study provides a key insight into the field, identifying trends and providing a visual analysis of publications in the CLP literature. As a result of the analysis of the data obtained from the WoS database, it was seen that the number of publications on CLP increased significantly on an annual basis. The increasing number of publications and the increase in the number of journals in which articles are published increase the area where the literature is distributed. Bradford's Scattering Law can help researchers know about a particular literature and choose the journals to publish their research. Bradford's Scattering Law "describes the scatter or distribution of literature on a particular subject" [3,4]. If you wish to compile a bibliography on a particular topic, a small core group will find that the journal always contains a significant (one-third) of the articles published in that topic or discipline. It is then seen that a group of second or more journals contains the other third of all articles, and a much larger group of journals the last third [3,4].

When the contributions of the countries to the literature were examined, the United States, the United Kingdom, Japan, People's Republic of China and Germany were in the top 5 places. If we open a special title for the People's Republic of China here, although the People's Republic of China is in the top 5 in the total number of publications, the fact that the centrality value is relatively low compared to other countries can be interpreted as low cooperation with other countries. However, when the subject headings in which the literature is divided are examined (Figure 2b-c), it is seen that the 'Chinese Population' (Cluster #6) cluster is such a large cluster that it can be in a separate place in the literature. Carefully following the study of the People's Republic of China in this area and increasing international cooperation with this country will make a great contribution to the literature.

Although most articles emphasize the importance of speech therapy [17, 18] and psychological support [19, 20] among the treatment steps of CLP, there is a lack of studies on these issues in the literature. Neither the clustering analysis nor the citation burst analysis found any findings related to these two issues. There are differences in the literature regarding the benefits of early intervention regarding the timing of speech therapy. The systematic reviews of Bessell et al. [21] and Meinusch and Romonath [22] found little evidence for the benefits of early talk therapy. However, in the systematic review published by Lane et al., it is suggested that early speech therapy before the age of 3 may be beneficial. Conducting more multidisciplinary studies will help us to see the effects of these two basic disciplines on CLP more clearly.

By examining the keywords, which are accepted as the spirit of the articles, many summary information about the publications can be obtained [1, 3, 8]. When Figure 3 is examined carefully, it is seen that the keywords include 2 different disciplines as surgery and genetics and that the keywords connecting these two disciplines are 'Cleft palate', 'palate', 'cleft lip and palate' , 'cleft lip' , 'lip', 'children', It can be said that there are keywords such as 'orofacial cleft'. The lack of direct linking paths from surgical keywords to genetic keywords can be interpreted as studies conducted in these two disciplines are independent of each other. The citation burst analysis of the keywords allowed

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issues will increase their importance in the coming years and will find more place in the literature.

Limitations

The study had certain limitations. Firstly, the data analysis conducted was incomplete as it only included English studies. To broaden the scope of the study's data, analysis could have been extended to other databases such as Scopus or Embase. However, this approach was not chosen due to integration issues between the data from the Web of Science (WoS) database and other databases. Consequently, information from other databases was not considered. Nonetheless, given the regular updates to the Web of Science database, there were an ample number of publications available to complete the study.

CONCLUSION

As a result, the general trend in this field, the topics on which the literature is divided, the most influential countries and journals were determined by scientometric analysis of the international publications that make up the CLP literature. The most influential countries in terms of centrality value were the United States, the United Kingdom and Germany, while the People's Republic of China had a significant number of publications in this field, despite its low centrality value. Significant progress can be made in the field of CLP by increasing international cooperation with the People's Republic of China. While the CLP literature is examined under 13 titles in general, the subtitles of Etiology and Single Nucleotide Polymorphisms appear as hot spots that continue to have an impact today, and it is estimated that this situation will continue in the coming years. With similar scientometric analysis studies to be carried out in the future, the progress of the literature can be followed and the future can be predicted.

Declaration of Conflicting Interests: The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding: The author received no financial support for the research, authorship, and/or publication of this article.

Patient Consent Statement: Is not applicable and not needed.

Ethical Approval: Is not applicable and not needed.

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How to Cite;

Balel Y (2024) Scientometric Research Analysis of Cleft Lip and Palate Literature: Hot Spots, Most Influential Countries / Journals, History and Future. Eur J Ther. 30(1):48-59. https://doi.org/10.58600/eurjther1680

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):60-65.
https://doi.org/10.58600/eurjther1891

Original Research

Imaging of the Ethmomaxillary Sinus, its Prevalence, and Evaluation of its Relationship with Chronic Rhinosinusitis

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Received: 2023-10-10 **Accepted**: 2023-12-14 **Published Online**: 2023-12-18

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This study was presented orally at the '1st International Congress of Selçuk Health Sciences' on Dec, 1-2, 2022, Konya, Türkiye. Its abstract was published in 1st International Congress of Selçuk Health Sciences Abstract Book.

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ABSTRACT

Objective: The presence of an ethmomaxillary sinus (EMS) may increase the susceptibility to inflammatory paranasal sinus diseases such as chronic rhinosinusitis (CRS) and cause difficulties in surgical interventions to the paranasal sinuses. Therefore, this study aimed to examine the EMS in patients with and without CRS.

Methods: The study included 150 patients (300 sides) diagnosed with CRS by the ear–nose–throat clinic and 151 individuals (302 sides) without CRS. Paranasal sinus computed tomography images were reviewed retrospectively. The presence of an EMS (bilateral or not) and its relationship with age and sex were examined. The severity of CRS was determined with the Lund–Mackay scoring system, and its relationship with EMS was evaluated.

Results: The EMS was detected in 7 patients (7/301, 2.32%) and 9 sides (9/602, 1.49%) of 301 patients (602 sides) included. The incidence in the CRS group was 2.6%. Three cases were unilateral, and one was bilateral. The incidence in the control group was 1.98%, two cases were unilateral, and one was bilateral. According to the Lund–Mackay scoring system, the mean CRS severity was 8.62 (±5.47). Its severity was 5.25 (±3.94) in the EMS group and 8.71 (±5.48) in the non-EMS group.

Conclusion: No statistically significant difference was found between the groups with and without CRS in terms of the presence of EMS ($p = 0.723$). No evidence reveals that EMS increased the severity of CRS.

Keywords: Ethmoid Sinus, Maxillary Sinus, Paranasal Sinuses, Sinusitis, Tomography

INTRODUCTION

Ethmoidal cells exhibit a complex anatomy with numerous interconnected cavities. In some studies, these cells are classified into anterior and posterior groups, while in others, they are further subdivided into anterior, middle, and posterior segments [1, 2]. This region harbors specialized air cells that arise from variations in the location, neighboring structures, and drainage patterns of ethmoidal cells. Notable examples of these specialized cells include Haller cells, Onodi cells, Agger nasi cells, retromaxillary cells (RMC), and the ethmomaxillary sinus (EMS). Understanding the detailed anatomy of the paranasal sinuses and these specific cell types is crucial for accurate disease characterization and surgical planning [3-7].

EMS is a variant paranasal sinus characterized by the presence of posterior ethmoid cells located in the upper part of the maxillary sinus (MS). It is adjacent to the posterior aspect of the MS and the orbital floor, with drainage into the superior meatus [7-10] (Figure 1). Retromaxillary pneumatization of posterior ethmoid air cells (RP.PEs) are air cells that occupy the same region as the EMS and are often mistaken for them. Several distinguishing features can be utilized to differentiate these two air cell types: EMS exhibits a prominent drainage duct, whereas RP.PEs do not. EMS is situated within the MS, while RP.PEs are located outside the MS wall. A maxillary septum separates EMS from the orbit, whereas an ethmoidal septum separates RP.PEs from the orbit [9].

It is believed that the presence of EMS affects the occurrence of chronic rhinosinusitis (CRS) and its treatment with functional endoscopic sinus surgery (FESS). Therefore, the detection of EMS before FESS is important. This is because highly pneumatized EMS can make it difficult to access the MS during FESS [7]. In addition, the anterior inferior wall of the EMS referred to as the ethmomaxillary plate (EMP), serves as the bony septum separating the EMS from the MS. If the EMP is identified before surgery and removed during FESS, a common drainage pathway is established for both the MS and EMS. As a result, the EMS is eliminated, preventing the persistence of potential inflammation within the EMS, and reducing the risk of recurrent CRS. Hence, surgeons should also consider the presence of variational structures during preoperative imaging [11].

Although the exact association between EMS and CRS remains unclear, it has been suggested that inadequate resection of ethmoid cells during FESS could contribute to CRS recurrence [7]. Persistent anatomical structures and incompletely resected cells may also lead to the progression of mucosal thickening [12]. Therefore, investigating the presence of variational air cells in the context of CRS and their persistence after surgery is crucial. The objective of this study was to determine the prevalence of EMS, assess its association with CRS, and examine its impact on the severity of CRS.

Main Points;

- In this study, the relationship between the ethmomaxillary sinus and the presence and severity of chronic rhinosinusitis was aimed to be evaluated.
- It was determined that the frequency of ethmomaxillary sinus occurrence did not differ significantly between individuals with and without chronic rhinosinusitis. Furthermore, no significant difference in the severity of chronic rhinosinusitis was found between patients with and without ethmomaxillary sinus involvement.

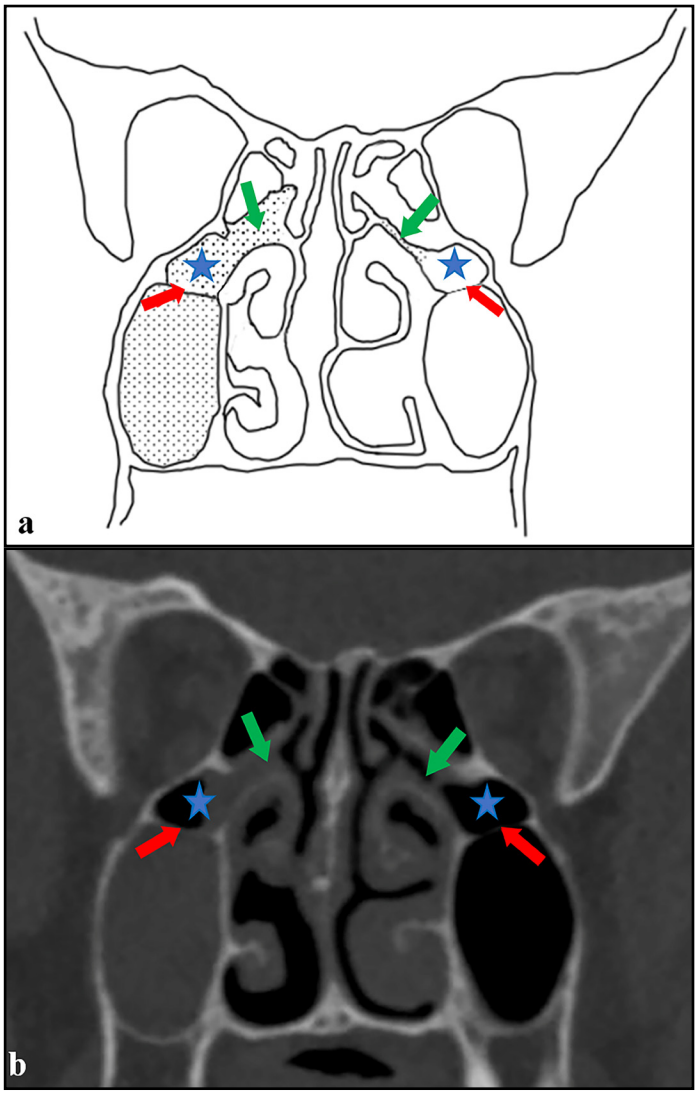

Figure 1. Bilateral EMS (Ethmomaxillary sinus) in a patient with chronic rhinosinusitis. There is inflammation in the left EMS that obstructs the ostium (schematic view **a**, paranasal sinus CT image **b**). Blue star, EMS; red arrow, ethmomaxillary plate; green arrow, opening of the EMS to the superior meatus

MATERIALS AND METHODS

Approval was obtained from the local ethics committee for the study. The research focused on the retrospective analysis of

paranasal sinus computed tomography (CT) images stored in the Picture Archiving and Communication Systems of Selcuk University Faculty of Medicine, Department of Radiology. The study conducted a power analysis to determine the most suitable sample size. According to the power analysis, the minimum sample size should have been 288, with 144 individuals in each group. Patients who visited the Ear, Nose, and Throat (ENT) clinic and underwent paranasal sinus CT imaging were screened. Sample selection was performed jointly by two ENT physicians. The patient group comprised 150 individuals with clinical diagnosis and imaging consistent with chronic rhinosinusitis, whereas the control group consisted of 151 individuals who had undergone CT imaging for reasons other than sinus-related issues, had normal paranasal sinus aeration, and lacked additional pathologies. Both groups were selected from individuals aged 18 or older without a history of paranasal sinus surgery or head trauma.

The images were acquired using a 256-slice CT device (Siemens Somatom Flash, Erlangen, Germany). The imaging parameters for the examinations were set as follows: kV at 100, matrix at 512 × 512, collimation at 0.6 × 128, rotation time at 1, and pitch value at 0.8. The obtained images had a section thickness of 1 mm and were assessed in the sagittal, coronal, and axial planes to investigate the presence of the EMS and the severity of CRS. The cases with EMS were identified based on the joint decision of a radiologist and an anatomist.

Based on the information extracted from patient files, the study examined the association between the EMS and the demographic characteristics of the patients, including age and sex. The prevalence of EMS was determined based on the analysis of the images, and the severity of sinusitis was assessed using the Lund-Mackay scoring system, which assigns a score out of 24 points, in patients diagnosed with CRS. It is important to note that for accurate scoring, all paranasal sinus structures and the osteomeatal complex should be present and evaluated in the computed tomography (CT) images. The study aimed to determine whether there was a correlation between the severity of sinusitis and the presence of EMS.

Statistical analyses were performed using the SPSS 22.0 Windows version software package. The Fisher's exact test was used for intergroup comparisons. A significance level of $p<0.05$ was considered statistically significant.

RESULTS

The CRS group consisted of 150 patients, with 49 women (32.7%) and 101 men (67.3%). Among the patients in this group, three out of four individuals with EMS were female, while one was male. The control group comprised 151 patients, with 72 women (47.7%) and 79 men (52.3%). Within this group, two out of three patients with EMS were female, and one was male. The age range in the CRS group was 18 to 72 years, with a mean age of 42.49 (±13.82) years. The average age of the four patients with EMS in this group was 43.5 years. In the control group, the age range was 18 to 73 years, with a mean age of 36.02 (±14.15) years. The mean age of individuals with EMS in the control group was 21.3 years.

The EMS identification criteria established by Liu et al. [9] were employed to diagnose EMS. Among the 301 patients (602 sides) whose images were examined, EMS was detected in 7 cases, resulting in a prevalence of 2.32% (7/301). Out of these patients, five had unilateral EMS, and two had bilateral EMS, resulting in a total of nine affected sides (9/602, 1.49%). In the CRS group, the incidence of EMS was 2.6%. Among these patients, three had unilateral EMS, and one had bilateral EMS (Figure 1a, b). In the control group, the incidence was 1.98%, with two cases being unilateral (Figure 2a, b) and one being bilateral (Figure 2c, d). There was no significant difference in the incidence of EMS between the patient and control groups ($p= 0.723$). Since bilateral EMS was observed in only one patient in each group, intergroup analysis regarding bilaterality couldn't be performed. Significant difference in the frequency of EMS occurrence between male and female genders was not observed ($p=0.122$).

The severity of CRS was determined using the Lund-Mackay scoring system [13], which evaluates severity on a scale of 24 points. The mean CRS severity score was 8.62 (±5.47) in the overall patient population. Among patients with EMS, the mean severity score was 5.25 (±3.94), while in patients without EMS, it was 8.71 (±5.48).

Since the EMS is primarily associated with the MS and ethmoidal cells, a new scoring system was developed using select parameters evaluated in the Lund-Mackay scoring system. The scoring was conducted on a total of 12 points. Among patients with EMS, the average score was calculated as 3.75, while it was 4.74 for patients without EMS.

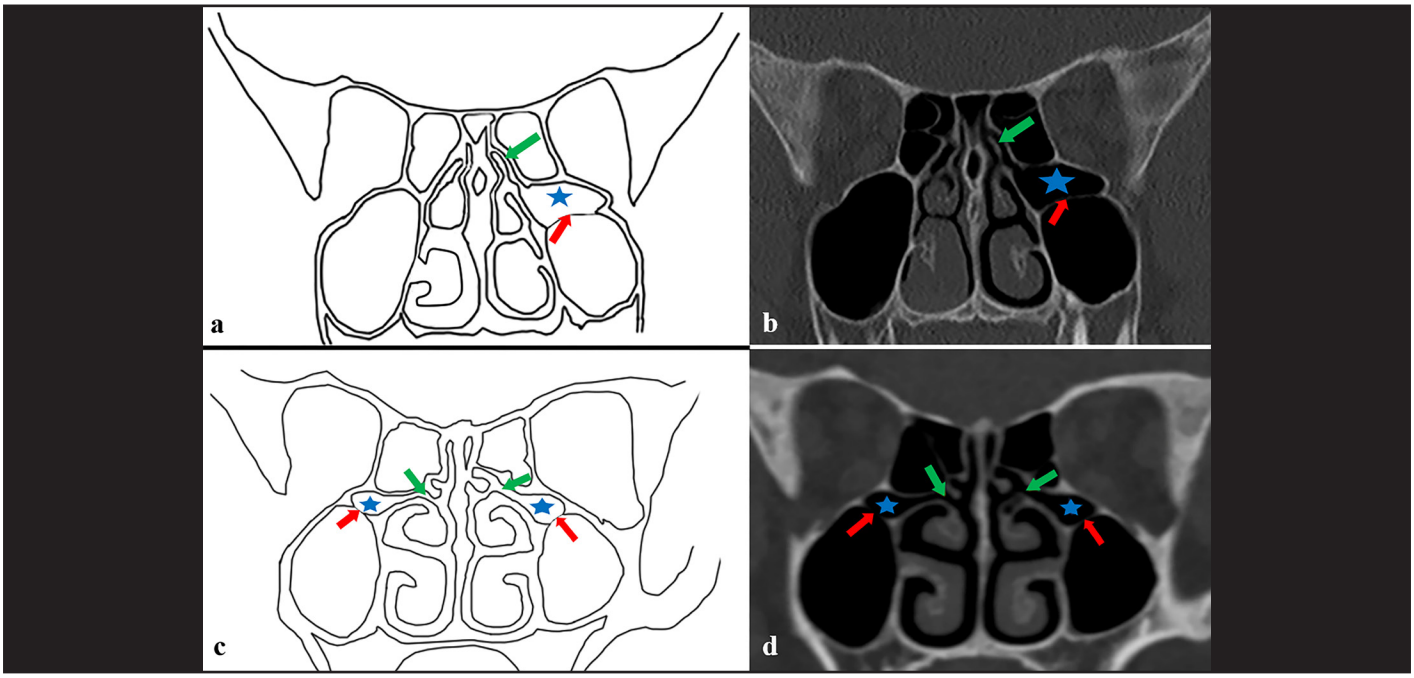

Figure 2. Left EMS (Ethmomaxillary sinus) in a patient without chronic rhinosinusitis (schematic view **a**, paranasal sinus CT image **b)**. Bilateral EMS in a patient without chronic rhinosinusitis (schematic view **c**, paranasal sinus CT image **d)**. Blue star, EMS; red arrow, ethmomaxillary plate; green arrow, opening of the EMS to the superior meatus

DISCUSSION

The definition of variational air cells, their relationship with each other, and diseases, is still being investigated, and their clinical effects have not been fully elucidated. Research on EMS has questioned its adjacency and association with other variational air cells. It has been reported that EMS is particularly associated with certain subtypes of cellular structures located in the posterosuperior part of the maxillary sinus and posterior ethmoid cells located in the retro-maxillary area [8, 14].

In the studies, topics such as the differentiation and characterization of the EMS from other air cells, its prevalence, degree of pneumatization, and its relationship with CRS have been discussed. This is motivated by the belief that identifying FESS can facilitate intervention and potentially reduce persistence when addressed [7, 9, 12].

In this study, a total of 9 EMS cases were identified, accounting for 1.49% of the 602 sides evaluated in 301 patients. Liu et al. reported a frequency of 7.1% [9], Zhou et al. reported 11.9% [7], Ozcan et al. reported 1.93% [15], and Sirikci et al. reported a frequency of 0.7% [10] for EMS occurrence. In a study conducted on the Russian population, the prevalence of EMS was found to be 2.4% [16]. The study conducted by Poojary et al. examined the posterior ethmomaxillary cell. This cellular entity shares the same anatomical characteristics as EMS and was found to have a prevalence rate of 11.4% [11]. Kim et al.'s study reported a prevalence of EMS at 10.4%. This study concurrently evaluated the presence of EMS and Haller cells, providing insights into coexisting variations in cells [17]. This variation in prevalence may be due to the lack of a single, universally accepted definition of EMS, differences in the interpretation of images by researchers, or the ethnic origin of the studied groups. Accurate detection of air cells such as PEs, which are anatomically located in the same region and can be confused with EMS, is also important for the correct calculation of EMS prevalence.

Kim et al. investigated the relationship between EMS and CRS in their study. They did not find statistical significance in terms of CRS frequency between the side affected by EMS and the side without EMS [17]. Data from studies revealing the frequency of inflammatory paranasal sinus pathologies in patients with EMS were as follows: Liu et al. reported a frequency of 60.9% for CRS in individuals with EMS [9], Ozcan et al. found a mucosal inflammation frequency of 44.4% in patients with EMS [15], while Sirikci et al. indicated a frequency of 50% for maxillary sinusitis and 10% for ethmoidal sinusitis in individuals with EMS [10].

When looking at the mean values of the Lund-Mackay and modified Lund-Mackay scores, our study did not find evidence supporting the exacerbation of CRS by EMS. Zhou et al. conducted a classification of EMS into types I, II, and III based on their size. However, when they separately calculated the Lund-Mackay score for each type, they did not find a significant difference in terms of chronic rhinosinusitis (CRS) severity [7]. Conducting a preoperative and postoperative prospective evaluation in patients with CRS can better elucidate the impact of EMS on the presence, severity, and recurrence of CRS.

Limitations

The limitations of our study included not evaluating the frequency of other variational air cells, not assessing the relationship of EMS with paranasal sinus pathologies other than CRS (such as maxillary hypoplasia, concha bullosa), and having a small sample size.

CONCLUSIONS

In our study investigating the frequency of EMS occurrence in CRS individuals, we did not identify a relationship between EMS and CRS. Additionally, no evidence was found suggesting that EMS exacerbates CRS.

Acknowledgments: The researchers would like to acknowledge the authors of the selected articles from which data were retrieved.

Informed Consent: A formal informed consent procedure was waived due to the retrospective nature of this study.

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical Approval: All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and itslateramendmentsorcomparable ethical standards. Ethical approval (approval number 2022/53) was given by the Non-Intervention Clinical Research Ethics Committee of the Medical Faculty.

Author Contributions: Design: Z,F; B,U- Project development: Z,F; B,U; M,T- Data collection and analysis: M,T; V,U; M,S,D- Review: Z,F; N,U,D; A,K,K- Writing: M,T; Z,F- Critical Review: Z,F; B,U.

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How to Cite;

Tasci M, Fazliogullari Z, Ulusoy B, Durmaz MS, Uslu V, Dogan NU, Karabulut AK (2024). Imaging of the Ethmomaxillary Sinus, its Prevalence, and Evaluation of its Relationship with Chronic Rhinosinusitis. Eur J Ther. 30(1):60-65. https://doi.org/10.58600/eurjther1891

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):66-74.
https://doi.org/10.58600/eurjther1974

Original Research

The Effect of Head Position on Buccal Cortical Bone Thickness Measurements in CBCT Scans: A Human Dry Mandible Study

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Received: 2023-12-22 **Accepted**: 2024-01-26 **Published Online:** 2024-01-29

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ABSTRACT

Objective: The aim of this study was to compare buccal cortical bone thickness measurements on cone beam computed tomography (CBCT) scans of human dry mandibles with direct measurements and to evaluate the effect of different head positioning on measurements.

Methods: In total, direct linear measurements were made at reference points on the buccal bone surfaces in toothless sockets in 26 human dry mandibles. CBCT scans were performed in the central position and with four different types of head position (to the right-left, to the anterior-posterior). Thickness measurements were performed on cross-sectional sections from relevant areas where heated gutta-percha was placed. Measurements were summarized as mean±standard deviation. Differences between measurements were analyzed by ANOVA and Friedmann test.

Results: Compared to direct measurements, buccal cortical bone thickness in CBCT scans was higher in the incisor and premolar regions, while lower values were obtained in the molar region. These differences were statistically significant but less than 0.2 mm ($p<0.005$). Different head positions had no effect on measurements on CBCT images ($p>0.005$). Intraobserver agreement for buccal bone thickness was found to be high (ICC=0.902-0.976).

Conclusion: It demonstrated a clinically acceptable difference between direct measurements and CBCT measurements of mandibular buccal cortical bone thickness. Additionally, no differences in measurements were observed between different types of head positions.

Keywords: CBCT, Head position, Buccal cortical bone thickness, Implant

INTRODUCTION

In dentistry, cone-beam computed tomography (CBCT) is widely used for three-dimensional imaging of the maxillofacial region due to its fast-scanning time, small size, lower cost and radiation doses compared to conventional computed tomography [1-2]. Especially in the recent increase in dental implant treatments [3], radiographic evaluation of the quantity and quality of alveolar bone is of critical importance in preoperative planning, length and width selection of dental implants, and the success of the treatment [4].

The alveolar bone of the jaws is more difficult to measure than the basal bone due to its thinness and proximity to the teeth and surrounding structures. Since linear measurements of alveolar bone are also used after orthodontic treatment and in the evaluation of periodontal status, the accuracy of the measurements is very

important [5]. Bone thickness measurements in cross-sectional images obtained by CBCT provide high accuracy and reliability [6-9]. However, there are several factors that affect image quality in CBCT scans. Among these factors, the patient's head position is a critical factor that can seriously affect the accuracy of measurements, especially in sensitive evaluations [10].

When the literature is evaluated, the results of studies investigating the effect of head positioning on measurements in CBCT images are controversial [11-16]. Although most authors argue that the measurements are not affected by different head positions [11-13], some authors claim that different positions have an effect on the results [14-16]. Human dry skull bones are frequently used to assess the accuracy of maxillofacial imaging modalities. Direct measurements made on the bones are the gold standard for these evaluations [13]. Many studies in the literature have generally evaluated the measurements of anatomical reference points [11-15]. There are studies evaluating the accuracy and reliability of CBCT measurements of buccal cortical bone with the effect of different factors (such as the use of different devices, different voxel sizes) [5,6]. However, there is only one study evaluating the effect of different head positioning [16].

The aim of our study was to compare CBCT measurements of buccal cortical bone thickness in edentulous sockets with direct measurements in the human dry mandible and to examine the effect of different head positioning on the measurements.

MATERIALS AND METHODS

This study was approved by the University ethics committee (ID: 2018-52). A total of 26 human dry mandibles that met the following inclusion criteria were used for the study: (1) adult mandible, (2) presence of edentulous socket, (3) absence of metals that may cause artifacts, (4) absence of any pathology and physical damage (such as trauma) to the mandible.

Main Points:

- Dental implant treatment applications have been increasing in dentistry in recent years.
- Accurate measurement of buccal cortical bone thickness on cone beam computed tomography is very important for implant treatment success.
- The minimal difference in patient head positioning does not affect CBCT measurements.

Direct measurements (Gold standard measurements)

In each mandible, on the buccal bone surfaces of the edentulous sockets, 2 mm below the alveolar bone margin, small points, each representing the area of interest, were marked with a black pencil. (Figure 1). A digital caliper calibrated to 0.01 mm was used to measure horizontally from each marked point perpendicular to the alveolar process. For buccal bone thickness measurements, 2 independent measurements (minimum 1 day apart) were taken from the relevant areas and the mean of these measurements was recorded. These measurements on dry human mandibles were considered as gold standard values.

CBCT scans

For standardization of CBCT measurements, radiopaque gutta-percha was used as a locator. The 2 mm pieces of gutta-percha cut into sticks were placed just below the marked areas on the bone surfaces as radiographic markers with dental wax (Figure 1).

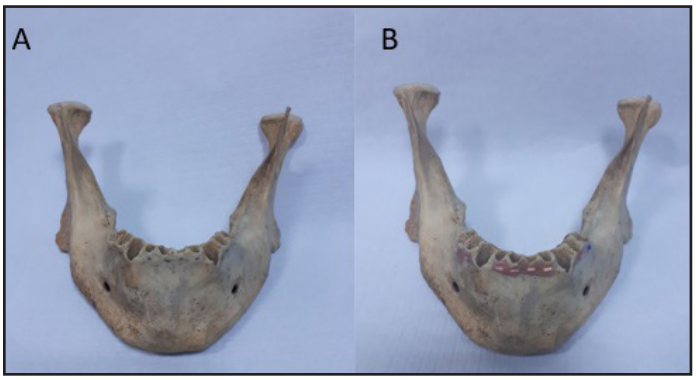

Figure 1. Preparation of bone A. Drawing with a pencil B. Application of heated gutta-percha.

Human dry mandibles were scanned using the Planmeca Promax® 3D Mid (Planmeca, Helsinki, Finland) CBCT device. Scanning parameters were 90 kVp, 8 mA and 0.4 mm voxel size, with a field of view (FOV) of 160x52 mm, where the full mandible was imaged. For scanning, the mandibles were placed in a glass box (20x20x20cm) placed on a styrofoam plate. The box was filled with water before imaging to simulate x-ray attenuation of soft tissues thickness [11,12,17]. Mandibles were stored in a dry environment before imaging to prevent expansion caused by water absorption. To ensure scan standardization, a line was drawn showing the midsagittal line of the box. The box and mandible were adjusted to the laser light of the device showing the midsagittal line (Figure 2A). Five different protocols were created according to movement during scanning:

- Protocol A: Central position; The midlines of the box and mandible were parallelized with respect to the CBCT laser light. The sagittal plane of the mandible was made parallel to the vertical plane.
- Protocol B: In right-left position, the box was angulated 10° to the right. 0° Angulation in anterio-posterior position.
- Protocol C: In right-left position, the box was angulated 10° to the left. 0° Angulation in anterio-posterior position.
- Protocol D: In antero-posterior position, the box was angulated 10° anteriorly. 0° angulation in right-left position.
- Protocol E: In antero-posterior position, the box was angulated 10° posteriorly. 0° angulation in right-left position.

Based on studies in the literature [14,15,18,19] and the pilot test, 10° was determined as the range of motion during CBCT scanning. Inclination in various directions was provided by a preset 10-degree inclined mechanism placed under the box. To prevent movement in positioning, the mandibles were fixed to the box with dental wax. To ensure consistency in rotation angles and orientation, tilt was checked using program tools in the images created after scanning. If there was any artifact in the image, the images were repeated. A total of 155 CBCT images were obtained by scanning 31 bones in five different protocols. Before the analysis, a calibration section was created and pilot measurements were performed on 5 mandibular CBCT images, and these mandibles were not included in the study. CBCT scan data for each mandible were saved as a digital imaging and communications in medicine (DICOM) file. All measurements were performed by a research assistant (with 2 years of experience in CBCT images-B.Ç) under the supervision of an experienced dentomaxillofacial radiologist (with at least 20 years of clinical experience-C.Ö.Ü). Radiographic evaluations were made in a light-reduced environment and from a distance of approximately 50 cm, using a 24-inch medical monitor with a resolution of 1920x1080 pixels, using the original program of the device, Planmeca Romexis 2.7.0.R computer program.

Cone Beam Computed Tomography Measurements and Evaluation

CBCT images of each bone were evaluated in the same order. Firstly, a panoramic curve was drawn on the axial images showing the sockets in the bone, passing through the center of the alveolar crest (Figure 2B). Panoramic reconstruction images (Figure 2C) and 3D CBCT scans (Figure 2D) were obtained. Cross-sectional sections were obtained from panoramic reconstruction images. For each socket site, cross-sections were determined at the midpoint of the radiopaque gutta-percha on the buccal bone surfaces. In these sections, linear measurements in mm were made using measuring instruments in a horizontal direction just above the gutta-percha (Figure 2E). Two measurements were made for each region and the average of these measurements was recorded. Due to the different orientations, measurements in the relevant socket regions, right and left, were recorded as anterior, premolar and molar regions. To evaluate intraobserver agreement, 15% of the radiographic measurements made by the observer were repeated 15 days after the first evaluation was completed.

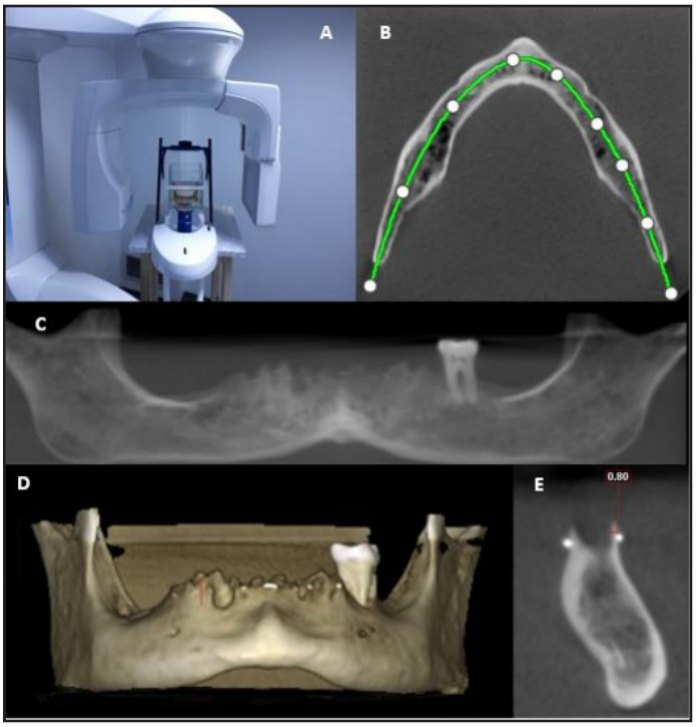

Figure 2. CBCT positioning and images A. Central Position, Protocol-A B. CBCT axial image panoramic curve C. Panoramic reconstruction image D. 3D CBCT scan. E. Measurement in cross-sectional section

Statistical Analysis

IBM SPSS Statistics V22.0 (Armonk, New York, USA) program was used for statistical analysis, calculations and graph drawing. The distribution of buccal cortical bone thickness measurements in the relevant areas were analyzed by Shapiro-Wilk test and normality plots. Measurements were summarized as mean±standard deviation.

The accuracy of CBCT measurements was analyzed by comparing direct measurements, which are considered the gold standard,

and CBCT images obtained with different protocols. While the measurements obtained from the images were compared with direct measurements, a two-way mixed ANOVA model was established, taking into account the type of edentulous socket area (incisor-premolar-molar) and side (right-left). In the model, simple contrast was defined so that the reference measurement was the actual measurement for comparison of each image with direct measurement (simple contrast). In addition, the differences between the measurements obtained from the CBCT images and the direct measurements according to the type of edentulous socket area and side were analyzed by repeated measures ANOVA and Friedman test. The intraobserver agreement between CBCT and direct measurements was evaluated with the intraclass correlation coefficient (ICC). A 95% confidence interval (CI) was given for ICC. Statistical significance level was accepted as $p<0.05$.

RESULTS

The buccal bones of a total of 178 edentelous sockets with 72 insicors, 56 premolars and 50 molars in 26 human dry mandibles were used in the study. The mean distributions of direct and CBCT buccal cortical bone thickness measurements are given in Table 1 according to edentulous socket area type and side.

In the measurements of buccal cortical bone obtained from CBCT images, higher values were obtained in the incisor and premolar regions, while lower values were obtained in the molar region compared to direct measurements (Figure 3) and this difference was statistically significant. However, the difference was less than 0.2 mm for all regions (A: $p<0.001$, B: $p=0.002$, C: $p=0.036$, D: $p=0.028$, E: $p<0.001$). The effect of head position on the measurements was examined by comparing Protocol A (Central position) with other protocols on CBCT images. No statistically significant difference was found between the images with changing head position (CBCT, $p=0.802$ for B-A, $p=0.181$ for C-A, $p=0.155$ for D-A, $p=0.717$ for E-A). The deviation of CBCT measurements from direct measurements was analyzed according to the type of edentulous socket area. Accordingly, no statistically significant difference was found between the methods in terms of deviation from direct measurements (Table 2).

Table 1. Average distributions of buccal cortical bone thickness measurements in the mandible according to the type of edentulous socket area and measurement techniques

	Edentulous Socket Area					
	Incisor		Premolar		Molar	
Measurement techniques	R, n=40 Mean±SD	L, n=32 Mean±SD	R, n=32 Mean±SD	L, n=24 Mean±SD	R, n=26 Mean±SD	L, n=24 Mean±SD
Direct	0.658±0.229	0.701±0.235	0.712±0.286	0.740±0.286	1.206±0.581	1.409±0.883
CBCT-A	0.771±0.229	0.797±0.205	0.903±0.306	0.813±0.241	1.234±0.410	1.345±0.934
CBCT-B	0.850±0.364	0.775±0.226	0.896±0.242	0.750±0.215	1.219±0.477	1.342±0.932
CBCT-C	0.770±0.306	0.838±0.276	0.855±0.247	0.754±0.246	1.179±0.414	1.305±0.861
CBCT-D	0.806±0.260	0.753±0.170	0.828±0.248	0.770±0.165	1.143±0.353	1.397±0.860
CBCT-E	0.860±0.308	0.800±0.203	0.843±0.235	0.819±0.225	1.188±0.395	1.400±0.878

CBCT, cone beam computed tomography, SD, standard deviation, R, right. L,left. n, noun. Unıt is mm.

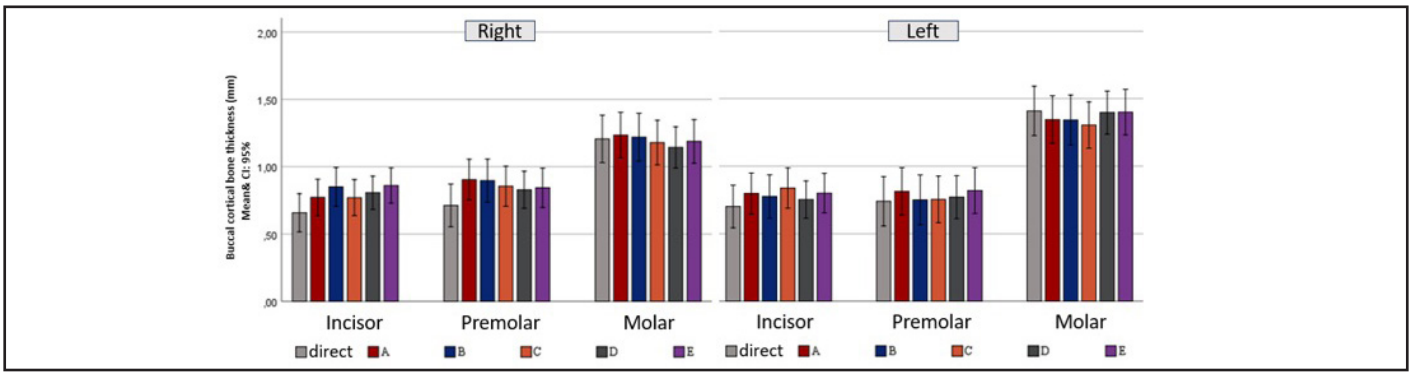

Figure 3. Distribution of buccal cortical bone thickness measurements according to edentulous socket type and side (CI: 95%)

Table 2. Differences between direct and CBCT measurements of buccal cortical bone thickness in the mandible according to the type of edentulous socket area

Edentulous Socket Area						
	Incisor		Premolar		Molar	
Measurement techniques	R, Mean±SD	L, Mean±SD	R, Mean±SD	L, Mean±SD	R, Mean±SD	L, Mean±SD
CBCT-A	0.114±0.206	0.096±0.211	0.191±0.322	0.073±0.168	0.028±0.349	-0.064±0.333
CBCT-B	0.193±0.309	0.074±0.194	0.184±0.25	0.01±0.312	0.013±0.252	-0.068±0.334
CBCT-C	0.113±0.272	0.136±0.267	0.143±0.251	0.014±0.275	-0.027±0.357	-0.105±0.275
CBCT-D	0.149±0.246	0.052±0.225	0.116±0.228	0.03±0.228	-0.063±0.361	-0.012±0.315
CBCT-E	0.203±0.249	0.099±0.227	0.131±0.265	0.079±0.252	-0.018±0.402	-0.009±0.364
p value	0.252	0.737	0.327	0.342	0.385	0.162

CBCT, cone beam computed tomography, SD, standard deviation, R, right. L,left. n, noun. Unıt is mm. *P < 0.05.

When the agreement between CBCT and direct measurements was evaluated, it was seen that it had a concordance value of at least 0.857 (95% CI: 0.744-0.881) (Table 3). According to ICC, values between 0.00 and 0.69 indicate unacceptable agreement, values between 0.70 and 0.84 indicate moderate agreement, values between 0.85 and 0.94 indicate high agreement, and values between 0.95 and 1.00 indicate excellent agreement. Accordingly, the agreement of the CBCT measurements with the direct measurements was high. Intraobserver agreement for buccal bone thickness was found to be ICC=0.902-0.976 (Table 3). This result supported that there was high agreement between the measurements and that the measurements were repeatable.

Table 3. Compatibility between CBCT and direct measurements and Intraclass correlation coefficient (ICC) for each of the CBCT measurements

	Direct measurement-ICC (95% CI)	Intraobserver agreement-ICC (95% CI)
Measurement techniques	Buccal cortical bone thickness	
A	0.857 (0.774-0.881)	0.902 (0.852-0.930)
B	0.868 (0.764-0.874)	0.976 (0.952-0.988)
C	0.852 (0.762-0.864)	0.923 (0.815-0.969)
D	0.885 (0.784-0.897)	0.919 (0.838-0.959)
E	0.877 (0.726-0.896)	0.975 (0.950-0.988)

DISCUSSION

In dentistry, determination of buccal bone thickness prior to immediate implant planning is of great importance for treatment success. CBCT is considered as the gold standard for the evaluation of bone quality and quantity in implant treatment planning due to its high dimensional accuracy in cross-sectional bone thickness measurement [20].

There are many studies evaluating the accuracy of CBCT in the literature. Most of the studies evaluated by making various measurements at anatomical landmarks [11,12,14,15]. Other studies have focused on the evaluation of different structures such as horizontal bone loss [21], edentulous socket dimensions and circumferential bone level [22], buccal alveolar bone height measurement [23]. There are studies evaluating the effect of different parameters on the measurements made in CBCT images. In these studies, parameters such as reducing the number of base images [16], using different voxel sizes [21,24], changing the radiation dose [25], using different devices [26,27], different head positioning [10-16,19,28] were examined.

It is noteworthy that these measurements are large in millimeters, as the measurements used in most studies often evaluate the distances between anatomical points. Structures such as cortical bone around the socket are very small and difficult to evaluate, and the number of studies on this subject in the literature is quite limited [16, 23]. In our study, unlike the literature, buccal cortical bone thickness measurements were made in three regions: incisor, premolar, molar, and the difference between CBCT and direct measurements, and the effect of different head positioning

on the measurements were evaluated.

Shokri et al. [14] found that in 3D scans in CBCT, transverse measurements between anatomical points in the maxillofacial region were lower than direct measurements on the skull, but this difference was approximately 1 mm. Timock et al. [23] using 12 cadaver heads evaluated the adequacy of CBCT in buccal cortical bone measurements. The results of the study showed that more than half of buccal bone thickness CBCT measurements were higher than direct measurements, while 41% were lower. Dings et al. [8] found an overestimation of 0.39-0.53 mm in CBCT measurements at different bone thicknesses in the craniofacial region. In our study findings, when compared to direct measurements in buccal cortical bone measurements obtained from CBCT images, higher values were obtained in the incisor and premolar regions and lower values in the molar region.

Our study shows that there is a difference of less than 0.2 mm between direct measurements and centrally located CBCT measurements. It is argued that radiographic measurements are acceptable if the difference between direct and radiographic measurements is one mm or less [28]. In our study, it was concluded that the intraobserver agreement method was highly reliable. Leung et al. [29] measured alveolar bone defect using CBCT with high reliability, which is consistent with the results of our study. The difference in results may be due to different software features of the systems used, calibration processes and the ability of the observer [26]. Additionally, Lund et al. [30] it is argued that voxel size is also effective in different estimations of measurements in CBCT scans.

In a study conducted on 7 dry sheep mandibles with a titanium pin inserted, Nikneshan et al. [28] concluded that angulation of -12^0 ve $+12^0$ on CBCT scans reduce the accuracy of linear measurements, but the margin of error is less than 0.5 mm and is within clinically acceptable limits. Hassan et al. [12] performed CBCT scans on a dry skull with ideal and rotated head positions. Their findings highlight that measurements in 3D images of CBCT scans are accurate and that small differences in head position do not affect measurement accuracy. El-Beialy et al. [13] evaluated the effect of 5 different head positions on different directional measurements in 3D CBCT images and found no change in the measurements of head position. As in most studies [11-13,28], the results of our study showed that different head positions did not affect CBCT measurements.

Unlike the studies in the literature, Nascimento et al. [16] investigated the effect of the number of CBCT basic images and head orientation on the measurements, in which they changed the rotation of the tube detector arm of the CBCT device (180^0 and 360^0) and the direction of the skull (90^0 and 180^0). As a result of their study on thickness measurements of the alveolar bone margin, buccal and lingual cortical bone in the anterior teeth of 11 dry skulls, it was reported that the number of basic images or head orientation did not have a consistent effect on the visualization of the alveolar bone, except for the lingual cortical bone. In this study, different protocols were created from our study by reducing device rotation and changing the head position to a wide angle in the horizontal plane. In our study, 10^0 angles were made, which is the amount likely to be encountered in the clinic [1,15,18,19]. One of the strengths of our study is the use of a larger sample size in this study, especially compared to studies in the literature that use dry human bones in CBCT studies [12-16,23,26,27].

Kamburoğlu et al. [31] evaluated furcation defects in three different voxel sizes (0.076, 0.100, 0.200 mm3). Cetmili et al. [21] examined horizontal bone loss on different surfaces of posterior teeth in dry skulls with two different voxel sizes (0.160, 0.250 mm3). In both studies, no difference was observed in the evaluations between voxel sizes. Kolsuz et al. [32] evaluated periodontal defects in six different voxel sizes ranging from 0.080-0.200 mm3. No statistical difference was found in the detection of all defects up to 0.150 mm3. In addition, when the caliper measures the bone from buccal to lingual, some of the volume of each voxel may be lost because each voxel has a volume in 3D images and the software measures the distance from the midpoint of the most buccal voxel to the midpoint of the most lingual voxel [14]. In our study, this may have affected our results, especially in thin structures, since the cortical thicknesses of the relevant tooth regions were different and were made in a single voxel size. Considering the differences between the studies, prospective studies evaluating the effect of voxel sizes can be performed.

Limitations

Our study has several limitations. First of all, we evaluated a single exposure parameter in our study. Considering that voxel dimensions affect the measurement values, this may have been the reason for the difference in measurements between cortical areas in our results. Another limitation is that the maxilla could not be included in the study due to insufficient number of bones.

In future studies, studies with different voxel sizes including both jaws should be performed.

CONCLUSION

The results of our study suggest that although there is a statistically significant difference between CBCT and direct measurements, this difference is within clinically acceptable limits (0.2 mm or less). Furthermore, different head positions during CBCT scanning do not affect the measurements. Therefore, we conclude that CBCT measurements can be safely used to assess buccal cortical bone thickness with minimal patient movement.

Acknowledgments: We would like to thank Prof. Dr. İbrahim TEKDEMİR and Ankara University Faculty of Medicine, Department of Anatomy for their contributions to this study.

Conflict of interest: The authors have no conflicts of interest to declare.

Running Head: The Effect of Head Position in CBCT Scans

Funding: The authors declared that this study has received no financial support.

Ethics Committee Approval: The study described in this article was conducted within the framework of the Declaration of Helsinki. Gazi University Ethics Committee approved the study (ID: 2018-52, approval date: 06.03.2018)

Authors' Contributions: Conception: BÇ,COÜ; Design: BÇ,COÜ; Supervision: BÇ,COÜ; Materials: BÇ,COÜ; Data Collection and Processing: BÇ; Analysis and Interpretation: BÇ,COÜ; Literature Review: BÇ,COÜ; Writing: BÇ Critical Review: BÇ,COÜ; All authors read and approved the final version.

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How to Cite;

Çelik B, Üçok CÖ (2024) The Effect of Head Position on Buccal Cortical Bone Thickness Measurements in CBCT Scans: A Human Dry Mandible Study. Eur J Ther. 30(1):66-74. https://doi.org/10.58600/eurjther1974

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024.;30(1):75-81.
https://doi.org/10.58600/eurjther1933

Review Article

A Scoping Review of the Role and Limitations of Surgical Versus Non-Surgical Management of Dentofacial Deformities

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Received: 2023-11-15 **Accepted**: 2023-12-18 **Published Online**: 2023-12-18

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ABSTRACT

Objectives: The amount of dermal filler procedures is increasing. Some patients opt to undergo dermal fillers instead of orthognathic surgery to treat unesthetic complaints from dentofacial deformities. The aim of this work is to carry out a literature review with regard to a comparison of role and limitations between aesthetic indications of orthognathic surgery and dermal fillers.

Methods: A scoping review was performed according to the PRISMA-ScR guidelines on Pubmed, Web of Science and Google Scholar. A second search was conducted to highlight topics very close subjects to the main subject: the importance of social media and measures to avoid litigation in facial aesthetics.

Results: Literature on the subject is very rare. Clinical facial analysis is fundamental to both procedures. Although patients wishes are important issues, facial analysis cannot be neglected due to its objectivity. Body dysmorphic disorder is considered a contraindication for both procedures. Social media is important in patient decision-making, but should not influence treatment planning by experts. Preventing litigation or reducing financial and reputational damage can be accomplished with a few simple steps.

Conclusions: A helpful list of indications and particularly contraindications for orthognathic surgery and dermal fillers was drawn up. Dermal fillers must not substitute orthognathic surgery. Further studies are urgently needed to discuss this contemporary issue.

Keywords: Aesthetics; Dermal Fillers; Facial analysis; Orthognathic Surgery; Scoping Review

INTRODUCTION

The attractiveness of the face is important to many people around the world. From experienced surgeons trough digital beauty influencers to many laypeople. Canons of proportionality and symmetry are keen on mankind for centuries [1]. Surgical and nonsurgical procedures are constantly evolving to achieve the "perfect face"; since the perfect face was attainable.

Orthognathic surgery, which used to be considered strictly functional surgery, plays an important role as an aesthetic intervention. Some articles report the search for orthognathic surgery as the main aesthetic procedure [2]. This can be explained by digital planning technology and the ability to more accurately simulation of the end results [3]. A non-surgical aesthetic

procedure is on the rise is winning the world, dermal fillers. The reversibility, low complication rate, efficacy and safety become dermal fillers one of the most frequently performed aesthetic procedures worldwide [4]. Due to financial and personal issues, dermal fillers substitute orthognathic surgery in some regions. Against this background some important questions arise: When should one or the other be selected? Personal opinion and experience are important or is there an algorithm in the selection? Depending on the patient´s desire, is there any difference in selecting one of them?

The literature on the cosmetic refinement of orthognathic surgery is limited. Therefore, we conducted a scoping review comparing the aesthetic importance, indications and limitations of orthognathic surgery and dermal fillers. The purpose was to examine the extent, range and nature of the existing literature on the aesthetic field in order to summarize the results and to visualize the range of material available to date on the subject to date, in order to identify research gaps that further research could answer. An evidence-based protocol proposal for the optimal choice of each patient was performed.

MATERIALS AND METHODS

This study has followed the PRISMA-ScR guidelines (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) for reporting scoping reviews [5]. Ethical approval and patient consent were not required because this article assess previously published studies. The PubMed, Web of Science (WS) and Google Scholar (GS) databases were searched using the following strategy: ((“facial aesthetics” OR “facial esthetics”) AND (orthognathic surgery OR dermal filler OR hyaluronic OR polycaprolactone OR hydroxyapatite) NOT review). Due to novelty of the dermal fillers topic, only articles from 2010 onwards were included. No restriction on language and country of origin were applied. Results were checked for duplicates, and titles, abstracts and full texts were evaluated to exclude irrelevant articles.

Main Points;

- This review assesses aesthetic aspects, indications, and limitations of orthognathic surgery and dermal fillers, proposing an evidence-based protocol.
- Orthognathic surgery evolves for aesthetics; dermal fillers gain popularity. Limited literature prompts exploration; an algorithm for procedure selection is proposed.
- A personalized algorithm suggests choosing between procedures based on facial concerns, emphasizing individualized planning and patient preferences.
- Beyond procedures, the review addresses social media impact, psychological assessments, litigation concerns, and the need for further research on refining facial aesthetics.

Inclusion criteria were (1) assessment of facial aesthetics, (2) clinical or tomographic analysis of the face, (3) orthognathic surgery, dermal fillers, or both. Exclusion criteria were (1) syndromic, cleft lip/palate or a head and neck pathology patients, (2) facial impairment due to trauma, (3) reviews, editorials, letters, commentaries, (4) poly-L-Latic acid filling due to its non volumization properties, (5) comparison between first-surgery and conventional approaches, (6) orthodontic camouflage, (7) animal studies.

Two authors (RG and AMB) independently extracted data from each included study according to the selection criteria. Any disagreements between reviewers were mediated by a third author (MAB). The search was conducted through May 2022. Factors included in the analysis were: author, year of publication, country of origin, patient sample, type and region of filling, other cosmetic procedures involved. Studies on aesthetics with orthognathic surgery or dermal fillers to elucidate some questions on the topic. A second manual search was conducted to answer two key questions on this topic: the importance of social media in making facial cosmetic decisions and avoiding litigation.

RESULTS

Searching databases identified 416 articles, 319 of which were duplicate or irrelevant articles. All 97 articles were screened by title and abstract. The reviewers have identified only four articles that met the inclusion criteria in this review. Fifteen of these articles were added to highlight the discussion (Figure 1).

An Italian retrospective study by Raffaini et al [6], examined patient satisfaction with a secondary orthognathic surgery. Aesthetic results have been discussed and the authors report three basic steps to achieve them: patient selection, three-dimensional diagnostics and planning, as well as appropriate intra-operative maneuvers. It was recommended to use a test to detect body dysmorphic disorders. Lipofilling has been described as an excellent alternative to correct some minimal unaesthetic results after orthognathic surgery.

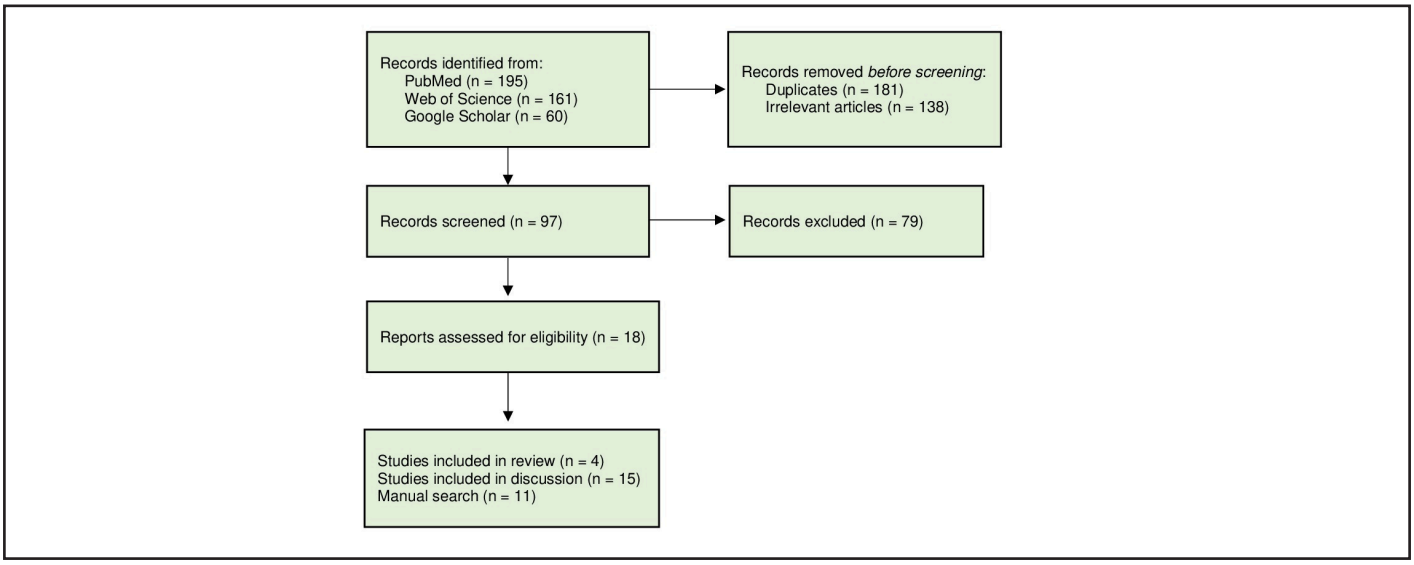

Figure 1. Flowchart of included studies

In a case report by Dall´Magro et al, [7] the authors affirm the importance of multidisciplinary functional and aesthetic outcomes achieved through orthognathic surgery combined with dermal fillers. The same was reported by Wollina and Goldman [8] who discussed lip filling after orthognathic surgery.

Grillo et al [9] in a 2022 case series involving three patients undergoing orthognathic surgery, discuss the need for aesthetic refinement in some cases. Although the functional outcomes of orthognathic surgery is an important goal, aesthetic concerns should not be neglected. Maxillofacial surgeons should understand the importance and must use or recommend botulinum toxin, dermal fillers and facial threads to achieve greater patient satisfaction. Table 1 summarizes these articles.

Fifteen articles from the first search related to the topic have been added. Seven studies [10–16] discussing the importance of the esthetic indication in orthognathic surgery were included. Despite the functionality of orthognathic surgery, the aesthetic impact on the patient´s quality of life must not be ignored. Six studies reporting facial reshaping using dermal fillers and cosmetic outcomes of this procedure were included [17–22]. Three studies have discussed alloplastic implants to improve facial aesthetics [20,23,24]. There are several articles associating dermal fillers to rejuvenation, but very few refer to the improvement of cosmetic surgical procedures, particularly orthognathic surgery.

A second search added two update questions on facial aesthetics. First, patient searches on social media to gather information about these two procedures [18,25–29]. The strategy used was the following: ((orthognathic OR dermal filler) AND social media). Secondly, the prevention of litigation related to orthognathic surgery and non-surgical cosmetic procedures using written consent [10,30–35]. The strategy used was the following: ((orthognathic OR dermal filler) AND litigation).

Table 1. Orthognathic surgery and dermal fillers refinement included articles.

Reference	Origin	Type of Study	Patient Sample	Type of Filling	Region Filling	Other Procedures
Dall´Magro et al, 2021	Brazil	case report	1	HA	Lip	bichectomy, gingival plastic surgery, tooth bleaching
Raffaini et al, 2018	Italy	retrospective study	70	fat	Face	
Grillo et al, 2022	Brazil	case series	3	HA	Lip	botulinum toxin, facial threads
Wollina, Goldman, 2017	Germany	case series	3	HA	Lip	botulinum toxin

Legend: HA: hyaluronic acid

DISCUSSION

Rustemeyer et al. [10] released a very important statement on facial cosmetic procedures. Although judging facial beauty is subjective, judging facial proportions is objective. Despite massive differences in cultural and ethnic features worldwide, facial harmony is a cornerstone [12,14,16,22,23,36,37]. Clinical facial analyses, complemented by imaging studies, are basilar to achieve a more proportionate face and achieve a more attractive face, without leaving aside functional outcomes [10,14].

Orthognathic surgery is responsible for enhanced aesthetic and functional outcomes [12,15]. It is considered a very unique surgery since as it achieves an amazing balance between hard and soft facial tissues [13]. Patients reports quality of life, satisfaction and self-confidence could reaching a level never imagined by their own. Sinko et al [12] reported that Class III patients look smarter after orthognathic surgery. In the case of unaesthetic complaints, a reoperative orthognathic surgery must be very evaluated very carefully. The second orthognathic surgery is usually more difficult and more extensive, increasing the risk of a poor outcome and achieving the desired results [6].

In the case of unaesthetic defects and functionally positive results, a facial filling must be used [6,7]. Some indications for dermal fillers on cosmetic refinement include facial reshaping, volume restoration and increase of symmetry [7,9,17–19,22]. Overuse of dermal fillers should be avoided, which could lead to unsatisfactory effects [19,21,38]. Although the volume of fillers is low, there is no algorithm that follows the anatomic region and the amount of fillers used. Despite this affirmation, lip filling is a popular non-surgical procedure associated with orthognathic surgery [7–9]. It adds volume to the lips, eliminates flatness, and enables for a more pleasing facial profile. The relationship between the size of the lips and the chin in profile view can be used as a guide [21]. Extremely caution must be taken into the nasolabial and paranasal regions aesthetic planning and treatment because of their importance in overall facial aesthetics [11,14–16,20,23,36]. For larger volumes, procedures other than dermal fillers such as alloplastic implants must be discussed and planned with the patient [20,23]. There is no magic formula, each treatment must be individually planned and tailored [7,10,22].

Important issues relate to the costs and the need for constant repetition of the procedure due to its long duration [20,24]. Although dermal filling is considered a safe and effective procedure [8], patients must make the choice to have this procedure based on a few factors including cost, duration, and expectations. A paramount issue when it comes to orthognathic surgery and dermal fillers is digital planning. While virtual planning on orthognathic surgery is a feasible and common step with a high accuracy rate, dermal filling still lacks software with the same accuracy and predictability.

Orthognathic surgery is a viable procedure to achieve aesthetic results, but refinement can enhance these results, leading to higher patient satisfaction. Unusual orthognathic surgical steps could be added to achieve better facial aesthetics, such as malarplasty, mandibular angle reduction and corticectomy [13]. Several aesthetic procedures can be combined synergistically with orthognathic surgery to improve the end result, such as botulinum toxin, facial threads, filling, bichectomy, liposuction, and alloplastic implants [9–11,18,23,24,37]. An algorithm regarding indications and contraindications for both procedures was proposed according to the existing literature on the subject (Table 2).

Table 2. Indications and contraindications for orthognathic surgery and dermal fillers due to aesthetic discomfort

	Indications	Contraindications
Orthognathic surgery	- skeletal discrepancies - functional concerns (i.e. chewing, breathing, speaking, obstructive sleep apnea) - massive aesthetic complains - oblique and sagittal smiling profile alterations	- body dysmorphic disorders - poor residual aesthetic outcomes (reoperation)
Dermal fillers	- rejuvenation - facial reshaping without functional issues - poor residual aesthetic outcomes on orthognathic surgery (reoperation)	- body dysmorphic disorders - midfacial augmentation - mandibular prognathism - maxillary protrusion - functional concerns

The assessment of psychological features must be mandatory in cases of suspicion. Body dysmorphic disorder is associated with up to 15% of patients requiring a reoperative aesthetic treatment [6,10] and orthognathic surgery as dermal fillers need to be incorporated into this list. Cases of heightened aesthetic concerns, repetitive behaviors, camouflage, functional impairment, and other psychological comorbidities should undergo a mental

health evaluation before any cosmetic treatment [6,10].

The impact of social media on the decision to undergo cosmetic procedure is increasing, independently of orthognathic surgery [6,10,25–28] or dermal fillers [18,29]. This internet material is considered to be of poor quality and lacking in information [26,28,29]. Despite some social media groups on this topic encourage patients, they should not influence the planning and treatment carried out by professionals, which could lead to an increase in orthognathic reoperations [27,28].

The patient´s aesthetic dissatisfaction is a factor that causes some discomfort but does not constitute malpractice [30]. Professionals may face litigation if patients have not signed appropriate written consent [31,32]. Cultural adjustments with written consent are recommended, as cultural patterns lead to disobedient behaviors [33,39]. Tailored written consent could be crucial to avoiding litigation or preventing major financial harm due to significant cultural differences [34,35,39].

Although several articles on orthognathic surgery have discussed facial aesthetics, very few are related to cosmetic refinement of orthognathic surgery, regardless of the procedure used. There is a lack of available evidence on the topic. Further studies using dermal fillers to improve facial aesthetics after orthognathic surgery are needed. Patient satisfaction, mental health assessments and indications for these adjunct procedures need to be evaluated.

CONCLUSIONS

A proposed algorithm for choosing between these two procedures could help maxillofacial surgeons, especially with contraindications for each procedure. Dermal fillers must not be overused to solve cosmetic and notably functional questions only for reasons of greater technical viability. Orthognathic surgery must be relentlessly discussed with the patients as one of the most feasible options to achieve facial harmonization. Further studies evaluating the association between orthognathic surgery and dermal fillers refinement are needed.

Funding: No source of funding

Competing interests: Authors declare that they have no conflicts of interest to disclose.

Ethical approval: Not applicable.

Author's contribution: All authors contributed equally to this manuscript, with substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data. All authors drafted and critically revised the content. All authors read and approved the final version of the manuscript.

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How to Cite;

Grillo R, Meireles Borba A, Slusarenko da Silva Y, Aparecida Brozoski, M (2024). A Scoping Review of the Role and Limitations of Surgical Versus Non-Surgical Management of Dentofacial Deformities. Eur J Ther. 30(1):75-81. https://doi.org/10.58600/eurjther1933

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):82-83.
https://doi.org/10.58600/eurjther1984

Letter to Editor

The Environmental Impact of Clear Aligners: Is Recycling and Waste Management Controlled?

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Received: 2023-12-27 **Accepted**: 2024-01-29 **Published Online**: 2024-01-30

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Dear Editor,

Clear aligner therapy has increasingly gained popularity in recent years [1]. This orthodontic treatment method was first introduced into the literature in the early 20th century. As of 2019, approximately four million individuals were reported to have undergone this treatment, a number that has since risen to over twelve million [2]. Furthermore, the rapid increase in the number of manufacturers producing clear aligners, reaching twenty-seven globally, indicates a swift upward trajectory in these figures [2,3]. Typically, clear aligner materials include thermoplastic components such as Polyethylene terephthalate glycol (PETG), Polyurethane (PU), and Multilayer aromatic thermoplastic polyurethane/copolyester (TPU) [4].

These thermoplastic materials are preferred for their physical properties [5]. However, what happens to these clear aligners that are used every week? What do individuals do with them after ten days? Considering an average arch length of 10 cm and a width of 4 cm, a single aligner is expected to have a surface area of 40 cm^2. Both the upper and lower dental arches contain approximately 80 cm^2 of thermoplastic material. Examining the treatment packages offered by manufacturers reveals an average of 80 aligners for both arches. Excluding the residual thermoplastic from production, the treatment of an average individual involves the production of 640 cm^2 of thermoplastic. When considering the reported total number of patients worldwide, this suggests the initiation of a significant plastic waste cycle associated with this treatment. In addition to the manufacturing of clear aligners, the models produced by manufacturers or clinicians also constitute a waste product [6]. However, according to the waste legislation of the countries where the manufacturer companies are located, these plastic wastes are controlled according to legal procedures for recycling. For this reason, we think that the outcome of the clear aligners produced in the manufacturing company and reaching the patient through the clinician is more important.

Globally, the environmental pollution caused by plastic materials is reaching dramatic levels [7]. In this context, the development of recycling methods is emphasized as a necessity [8, 9]. While the toxicity of these aligners in individuals has been investigated, there is a lack of literature regarding the post-treatment of these aligners or how these plastics can be recycled. Our main

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emphasis in the recycling of clear aligners is the uncontrolled disposal into the nature rather than their reusability.

Align Technology company states that they attach importance to the recycling of the materials used in this regard. However, it also states that they have started a plot study with a limited number of clinicians in America and Brazil. In addition, the fact that they are open to suggestions and cooperation on recycling is an indication that concrete steps will be observed in the future [10]. However, we think that such a situation should be considered not only by one manufacturer, but by all stakeholders such as all manufacturers, in-house producers and clinicians. At this point, informative and warning texts and brochures about the recycling of these plastic materials should become widespread and awareness should be raised on the websites of the manufacturers and in the clinics that are the practitioners of these companies. In addition to information, taking these aligners back during the controls or doing the necessary work to recycle them will help this popular treatment method to become more aesthetic and effective as well as more environmentally friendly. Furthermore, these clear aligner materials can be considered as medical waste. At this point, I think that new legal arrangements should be made regarding in-house production or clinics that apply clear aligners.

Kind Regards

Keywords: Clear aligner, recycling, environmental pollution

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How to Cite;

Tunca M (2024) The Environmental Impact of Clear Aligners: Is Recycling and Waste Management Controlled?. Eur J Ther. 30(1):82-83. https://doi.org/10.58600/eurjther1984

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):84-86.
https://doi.org/10.58600/eurjther1808

Letter to Editor

The Role of Artificial Intelligence (AI) in the Academic Paper Writing and Its Prospective Application as a Co-Author: A Letter to the Editor

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Received: 2023-08-21 **Accepted**: 2023-08-24 **Published Online**: 2023-08-24

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Dear Editors,

I have read your editorials with great interest [1,2]. I am interested in sharing my insights concerning the role of artificial intelligence in composing scholarly articles, along with its potential as a collaborative co-author. I extend my heartfelt gratitude for establishing this profoundly valuable platform for discussion.

I am aware of the imperative to renew myself academically daily. Perhaps the most exquisite yet arduous facet of academic life resides herein. Sustaining the currency of my domain knowledge, tracking technological advancements, and aligning with the latest research trends often pose formidable challenges. However, these challenges also furnish avenues for continuous self-improvement and exploring topics demanding more profound comprehension. In addition to the facilitation of information access afforded by computers and the internet, artificial intelligence has been incorporated in recent years—my inaugural encounter with artificial intelligence manifested through applications utilized on telecommunication devices. Artificial intelligence finds application across various domains and displays a swiftly burgeoning spectrum of applications. In recent years, significant advancements have transpired in artificial intelligence, culminating in the emergence of numerous Large Language Models (LLMs). Introducing sophisticated and diverse language models has precipitated a remarkable leap in this domain. One such model is the artificial intelligence conversational robot named ChatGPT, equipped with the GPT-3.5.5 language model, which OpenAI unveiled on November 30, 2022. Impressively, this model garnered one million users within five days. Within the academic literature, ChatGPT, a Chat Generative-Being Transformer, is widely acknowledged as a substantial and versatile information resource [3]. So, can ChatGPT be used safely for manuscript writing? As academics, we know that writing an article and adding new knowledge to the literature requires serious dedication. In this context, using ChatGPT for article writing involves significant risks [4]. The biggest problem is accuracy [5]. Artificial intelligence draws its data from the internet environment, where the veracity and reliability of information are persistently subject to debate. The accuracy and reliability of data on the Internet is always controversial. ChatGPT can produce factually inaccurate and inaccurate texts, create biased texts, and in particular, this can undermine the credibility and authority of researchers. Another most critical problem is that it includes ethical concerns.

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However, we cannot overlook the fact that with the advancement of technology, artificial intelligence has been progressing toward the core of our lives. As a solution, I think that artificial intelligence should be employed with caution, considering its ethical problems, the potential for misapplications, and plagiarism-related concerns. Notably, it can contribute to refining written text rather than printing the entire article. In addition, as you stated, the role, contributions, and process of ChatGPT in the article should be clearly stated. In the literature, it has been said that ChatGPT contributed to various stages, such as data analysis, model development, and interpretation of results [6]. Susnjak [7] has argued that ChatGPT exhibits critical thinking skills and can generate highly realistic texts with minimal input, positing that this poses a threat in online examinations, particularly within higher education settings. Zhai [8] in the context of crafting articles encompassing education and artificial intelligence themes, has emphasized the assertion that ChatGPT could assist researchers in generating coherent, partially accurate, informative, and systematic articles. Alshater [9] has noted that ChatGPT has the potential to improve academic performance, underlined various limitations, such as ethical considerations, and emphasized the importance of combining human analysis and interpretation.

So, is it appropriate for ChatGPT to be credited as a co-author? This topic will always be controversial This matter will inevitably remain subject to ongoing debate. The scope of ChatGPT's contribution and the ethical considerations surrounding this practice, coupled with the continued discussions within the academic community, suggest that employing ChatGPT as a co-author carries substantial risks [10]. In a collaborative study where Perlman and ChatGPT served as co-authors [11], Perlman evaluated the text generated by ChatGPT and underscored the possibility of envisioning a new future by considering the ethical concerns, faulty applications, and plagiarism issues associated with artificial intelligence. Similarly, in a comparable endeavor, Srivastava [12] was tasked with using ChatGPT to compose a conference paper and consequently emphasized that, under researcher supervision, ChatGPT could be an efficient application.

In conclusion, the assertion that artificial intelligence plays an increasingly significant role in research and scientific discovery is continuously gaining support. However, considering the meticulousness and accuracy required for establishing academic literature across all fields, ChatGPT's practice of generating academic articles from scratch and serving as an assistant author is not aligned with academic norms. There is a need for the development of more nuanced programs in this regard. Especially in the coming days, ChatGPT should prove the information it gives and present the right references for every sentence. Simultaneously, ChatGPT should be revamped in a format that can address ethical concerns.

Yours sincerely,

Keywords: Artificial Intelligence, Academic Article Writing, ChatGPT.

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Deniz G (2024) The Role of Artificial Intelligence (AI) in the Academic Paper Writing and Its Prospective Application as a Co-Author: A Letter to the Editor. Eur J Ther. 30(1):84-86. https://doi.org/10.58600/eurjther1808

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):87-88.
https://doi.org/10.58600/eurjther1755

Letter to Editor

Harnessing Artificial Intelligence in Academic Writing: Potential, Ethics, and Responsible Use

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Received: 2023-08-04 **Accepted**: 2023-08-05 **Published Online**: 2023-08-07

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Dear Editors,

I read your editorials with interest [1,2]. Artificial intelligence has become increasingly popular in recent years. Moreover, it is seen that valuable comments made on the article focus on issues such as potential harms in the academic use of artificial intelligence, publication ethics, and the ontological position of artificial intelligence [3-6].

As with other technological developments in our life, artificial intelligence seems to be increasingly present in our lives [7]. The use of artificial intelligence in article writing is a current topic of discussion. Writing an article from scratch with artificial intelligence doesn't seem quite right. The fact that artificial intelligence doesn't have an entirely independent thought structure, and that it obtains its information only based on the web, could lead to plagiarism. Also, it will not be fully understood whether it provides correct references and whether it violates the privacy of personal data. Furthermore, we do not find it correct to accept it as a co-author. Authorship carries a responsibility that an AI tool, no matter how advanced, cannot bear. Conversely, artificial intelligence will be incapable of assuming responsibility. So, should we stay away from artificial intelligence in this case? We believe the answer to this question is no. We can use artificial intelligence while writing an article, and it can facilitate our work. Finding a title after writing the article is an important issue. It must be impressive, and some journals have a character or word limit for the title. Artificial intelligence can help us in finding a title. Artificial intelligence can also assist in creating an abstract. Each journal has different rules about the abstract section. When rejected from one journal, it's necessary to create a new abstract for another journal. Artificial intelligence can speed up this process. When the article is ready, it needs to be checked for grammar and spelling rules. Artificial intelligence will be very useful in this situation. Preparing a good cover letter is important to attract the editor's attention. Artificial intelligence will assist in writing the cover letter. Although we think that artificial intelligence cannot be a co-author and cannot be used to write an article from scratch, we believe that we can benefit from artificial intelligence while writing our article. Using artificial intelligence will save us time. It will also help us write higher quality articles.

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In conclusion, artificial intelligence is now a part of our lives. Instead of avoiding it, we believe that we need to take advantage of artificial intelligence in a way that will facilitate our work.

Sincerely yours,

Acknowledgment: None

Conflict of Interest: No conflict of interest. No financial support was received.

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How to Cite;

Duymaz YK, Tekin AM (2024) Harnessing Artificial Intelligence in Academic Writing: Potential, Ethics, and Responsible Use. Eur J Ther. 30(1):87-88. https://doi.org/10.58600/eurjther1755

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):89-90.
https://doi.org/10.58600/eurjther1826

Letter to Editor

In the Anatomic Studies, Is It Correct to Add an Artificial Intelligence Such as Chatgpt as a Co-Author?

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Received: 2023-08-29 **Accepted**: 2023-09-02 **Published Online**: 2023-09-02

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Dear Editors,

I follow your journal with pleasure. I enjoyed reading your articles on artificial intelligence [1,2]. I would like to share my ideas with you about the use of artificial intelligence, which many researchers are currently curious about.

Health applications are being renewed day by day. New technology and new gains in treatment have made us curious about the use of artificial intelligence [3]. Health experts using methods such as machine learning and deep learning, which are sub-branches of artificial intelligence, are switching to new methods in processes such as diagnosis, treatment, rehabilitation, and health protection of diseases [4,5]. ChatGPT (Chat Generative Pre-trained Transformer), used in the studies and also added as a co-author, is ChatGPT, an artificial intelligence chatbot with the GPT-3.5.5 language model, which was released by the artificial intelligence research company OpenAI on November 30, 2022, and reached 1 million users in 5 days [3]. This robot can become a promising and powerful tool for tasks such as automatic drafting, article summarization, homework, and language translation, which can be useful for making writing work faster and easier in academic activities. Talan and Kalınkara [6] used ChatGPT in the Anatomy course and found that students performed better. Aktay et al. [7] stated that students found ChatGPT interesting and fun and that it increased students achievement. Saygın and Kabakcı [8] stated that the use of ChatGPT can be useful in information learning and in producing something new.

On the other hand, in a few studies, the addition of artificial intelligence as a co-author has been stated to be worrying [1,9]. If the academician does not produce it himself, but the artificial intelligence he uses as a co-author does, it may create an obstacle in multidisciplinary studies. If ChatGPT is written instead of a collaborator when you want to study anatomy, we are concerned about the decrease in our assistants, students, and research scientists.

As a result, ChatGPT can be used in the learning of the Anatomy course and can also be useful in increasing knowledge in academia, but I do not find it ethically correct for ChatGPT to do the work that master's and doctoral students have done for years in master's and doctoral studies in a short time. In addition, in the studies on Anatomy, while writing a scientist is a co-author,

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the inclusion of ChatGPT will pave the way for the production of studies without labor in a short time, and this will cause serious concerns in academia. It will save time in academia, but academics' communication with each other will decrease, there will be no cooperation and multidisciplinary studies will decrease. Who will be responsible in case of any problems while participating as a co-author with ChatGPT? I think that the use of ChatGPT should be supervised and that it is worrying to be a co-author at the moment.

Yours sincerely

Keywords: Artificial Intelligence, ChatGPT, Anatomy

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How to Cite;

Bağcı Uzun G (2024) In the Anatomic Studies, Is It Correct to Add An Artificial Intelligence Such as Chatgpt as A Co-Author?. Eur J Ther. 30(1):89-90. https://doi.org/10.58600/eurjther1826

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):91-95.
https://doi.org/10.58600/eurjther1996

Letter to Editor

Effect of Extracorporeal Shock Wave Therapy and Dry Needling in Treatment of Impingement Syndrome

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Received: 2023-12-27 **Accepted**: 2024-01-29 **Published Online**: 2024-01-30

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Dear Editor,

Injuries to the shoulder joint have been very common throughout society. There are several common shoulder diseases, including rotator cuff tears, osteoarthritis, shoulder impingement, bursitis, and cervical radiculopathy, which result in shoulder girdle muscle dysfunction, and struggle with everyday tasks [1]of which osteoarthritis (OA. Impingement syndrome refers to rotator cuff abnormalities that encompass all stages of tendon degeneration. Shoulder impingement syndrome (SIS) is caused by compression of the teres minor, teres minor, supraspinatus muscle, soft tissues, biceps tendon, and subacromial bursa between the coracoacromial arch and humeral head. Shoulder discomfort may result from this disorder. Additionally, several structural and functional elements that reduce the subacromial space may potentially contribute to shoulder impingement [2]. Patients with shoulder impingement syndrome have persistent pain. Patients usually report shoulder discomfort in the anterior and lateral acromion regions, and it frequently extends to the lateral aspect of the midarm. When patients lie on the afflicted side, the discomfort can also induce stiffness and weakness; pain is the worst at night [3].

Numerous studies have pointed out the association between shoulder discomfort and myofascial trigger points (MTrPs). The tight bands of skeletal muscle have MTrPs, which are incredibly sensitive to pressure. These locations result in motor dysfunction as well as discomfort that can either be caused by compression or arise spontaneously. In terms of biomechanics, the scapula is critical to the function of the shoulder. The normal arthrokinematics at the gleno-humeral region might get disrupted as a result of a muscle imbalance. The discomfort and dysfunction resulting from MTrPs, which may alter scapulohumeral rhythms, could lead to the onset of subacromial pain syndrome. In addition to having high levels of acetylcholine and nicotinic receptor activation, studies have demonstrated that the subscapularis tendon and joint capsule also have significant levels of inflammatory mediators. These findings support the theory of the trigger points, which is still being debated [4]. Extracorporeal shock wave treatment (ESWT), a high-pressure sound wave, is applied to address damage to soft tissues and discomfort brought on by degradation of the musculoskeletal system. This technique is

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especially common for treating sports-related tendinopathies such as proximal plantar fasciitis on the heel, calcific or non-calcific tendonitis at the shoulder, and lateral epicondylitis of the elbow. Typically, ESWT is administered over the course of three sessions, one session per week [2]. The minimally invasive technique known as dry needling (DN) involves injecting a tiny needle into the skin all over. MTrPs, connective tissue, and muscles are stimulated as part of this procedure to alleviate pain and functional impairment. It is still unknown how all of these activities are created by the various systems. Nevertheless, has been proven in several meta-analyses that dry needling is helpful in reducing pain and may inactivate or destroy MTrPs in several musculoskeletal diseases. Using the fast-in and fast-out approach, dry needling intervention was used to treat trigger sites up to local twitch occurrence. Most frequently treated with supraspinatus and infraspinatus. With the exception of one trial, which employed three sessions in one week, dry needling treatment was performed in two or three sessions over a three to four-week period [4].

Patient information:

A 48-year-old delivery man visited the outpatient department with complaints of inability to lift his right arm while wearing his t-shirt with most pain while sleeping on his right side or scratching his back for about 2 months which increased gradually. He complains of most pain in the shoulder joint. He visited the orthopaedics department, which suggested an x-ray of the shoulder joint, which did not show any significant changes. He was then prescribed NSAIDS for pain and referred to physiotherapy for further management.

Clinical findings

He was examined in the high sitting position on the couch, he was asked to do Aples Scratch test, Neers Impermeant, Hawkins Kennedy, empty can and full can test which came out to be positive. There was grade 3 tenderness on the infraspinatus, supraspinatus, and rhomboid muscles. The range of motion in overhead flexion, extension and internal rotation was restricted due to pain leading to an empty Endfield (Table 1 and Table 2). Shoulder Pain and Disability Index (SPADI) score was 73% and Shoulder Function Index (SFInX) was 43.

Intervention:

ESWT- While sitting on the bed, the patient's elbow was bent 90 degrees and his forearm was neutral. The ESWT device's head was placed in a 90-degree, tangential position above the painful area. Safety earmuffs were worn by the patient and the operator to shield them from the device's deafening noise. The application area was cleaned with an iodine solution, and concussion intensity was increased by adding gel material. First, 500 shock wave pulses fired successively at a repetition rate of 5 Hz, then 1800 shock wave pulses fired successively at a repetition rate of 12 Hz, were used for three weeks, with three sessions, one every week [2].

Table 1. Isometric Strength

Muscles	Right	Left
Shoulder		
Flexors	Weak and Painful	Strong and Painless
Extensors	Weak and Painful	Strong and Painless
Abductors	Weak and Painful	Strong and Painless
Adductors	Weak and Painful	Strong and Painless
Internal Rotation	Weak and Painful	Strong and Painless
External Rotation	Weak and Painful	Strong and Painless
Elbow		
Flexors	Strong and Painless	Strong and Painless
Extensors	Strong and Painless	Strong and Painless
Supination	Strong and Painless	Strong and Painless
Pronation	Strong and Painless	Strong and Painless

Table 2. Range of Motion

Joint	Rt Active	Rt Passive	Lt Active*	Lt Passive*	Limitation
Shoulder					
Flexion	0-120^0	0-180^0	0-180^0	0-180^0	Unable to perform due to pain
Extension	0-30^0	0-180^0	0-180^0	0-180^0	Unable to perform due to pain
Abduction	0-110^0	0-180^0	0-180^0	0-180^0	Unable to perform due to pain
Adduction	0-110^0	0-180^0	0-180^0	0-180^0	Unable to perform due to pain
Internal Rotation	0-20^0	0-45^0	0-45^0	0-45^0	Unable to perform due to pain
External Rotation	0-25^0	0-45^0	0-45^0	0-45^0	Unable to perform due to pain
Elbow					
Flexion	0-120^0	0-120^0	0-120^0	0-120^0	NA
Extension	0-120^0	0-120^0	0-120^0	0-120^0	NA
Supination	0-100^0	0-100^0	0-100^0	0-100^0	NA
Pronation	0-80^0	0-80^0	0-80^0	0-80^0	NA

Dry Needling - Over the rhomboids, infraspinatus, and supraspinatus muscles, dry needling was used to minimize discomfort and trigger points [5].

Exercises- The exercise regimen comprised finger stair exercises, posture, pectoral and trapezius stretching activities, shoulder range of motion exercises, and shoulder stretching exercises. Exercises for rotator cuff and scapular muscle strengthening were undertaken once the patient had reached an active full range of motion. He was first instructed to complete each exercise, which consists of one set of five repetitions, three days a week. The number of workout sessions and series for each exercise was increased, progressively raising the exercise intensity. Over the course of four weeks, the workout program was performed once a day, five days each week, with 10 to 15 repetitions [6].

Timeline

Date of physiotherapy reference - 02/11/2023
Date of assessment - 05/11/2023
Date of commencement of treatment – 06/11/2023
Date of last follow up – 5/12/2023

RESULTS

The outcome measures used in the study were VAS for pain assessment, ROM assessment for movement of joints, isometric strength for assessing muscle strength, and the Shoulder Pain and Disability Index (SPADI) and Shoulder Function IndeX (SFInX) for assessing pain-related disability in day-to-day life.

Figure 1. Post rehabilitation increased range of motion (Flexion)

The data was collected at the initial evaluation and after 4 weeks. The patient has made significant improvements in all functional areas, as evidenced by pain reduction, improvements in joint range of motion (Figure 1), and muscle strength. The muscles on the right side were relaxed, with no pain and no tenderness on palpation. His right scapula was no higher than the left side. Shoulder pain reduced from 7/10 to 1/10 during activity. SPADI was 2.3% and SFInX was 89.

DISCUSSION

Patients who suffer from shoulder impingement syndrome have constant pain. Patients often describe shoulder pain radiating to the lateral side of the midarm and originating mostly in the anterior and lateral region of the acromion. Patients who are lying on the afflicted side have more pain at night and during these times. Pain might occasionally also be accompanied by stiffness and weakness which coincided with the patient's chief complaints and reconfirmed with a special test which came positive [3]. ESWT is a popular and efficient treatment for treating shoulder and elbow chronic tendon issues as well as for reducing heel pain. When concentrated ESWT was used in conjunction with isokinetic exercise to rehabilitate the rotator cuff in individuals with SAIS, it offered a larger short- to medium-term decrease in discomfort, better recovery in functions, and improved muscular endurance than ESWT alone [2], which helped a lot with pain. MTrPs are extremely sensitive pressure receptors in the tight bands of skeletal muscle that are also very irritable sites. Due to MTrPs' impairment and discomfort, that might alter scapulohumeral rhythms, subacromial pain syndrome could occur. Dry needling regulates MTrPs, connective tissue, and muscles to reduce pain and functional impairment. A reduction in sensitizing chemicals like bradykinin and calcitonin might result after dry needling since it increases blood flow in MTrPs. Additionally, it might lessen synaptic and pH abnormalities, restoring a normal amount of enzymes like acetylcholinesterase where they are needed, and reducing the malfunctioning of the MTrPs' motor plate as a result [4], which helped him to get rid of the tender points and taught bands thus restoring the movements.

Exercise is usually recognized as a helpful intervention for treating symptomatic rotator cuff tendinopathy; however, combination therapy involving exercise and other therapies may be more beneficial than single-intervention therapies in treating this condition [6] which reinforces the idea of using combination therapy. A shoulder exercise program seeks to minimize pain, increase strength, speed up healing, correct abnormal imbalances in muscles, and regain pain-free joint range of motion. Exercises involving stretching assist in speeding up healing as well as reducing stiffness and enhancing suppleness in the tendon. By strengthening the rotator cuff muscle using isometric and isotonic activities, the deltoid muscle's activity may be regulated once again. Electromyographic investigations have revealed that SAIS subjects had elevated action of the upper trapezius, diminished activity in the serratus anterior, middle, and lower trapezius fibres, and abnormalities in asynchronous timing. Scapular stability exercises are therefore included in the rehabilitation of those with SAIS helped us with deciding the exercise regime [7]strength, function, and quality of life. Data were summarized qualitatively using a best evidence synthesis. Treatment effect size and variance of individual studies were used to give an overall summary effect and data were converted to standardized mean difference with 95% confidence intervals (standardized mean difference (SMD. Minimizing pain in the shoulder while improving the function of the shoulder were the objectives for physiotherapy in rotator cuff tendinopathy in these researches. All of the programs that were examined focused solely on muscle growth [8], and encouraged us to include isometrics and free exercises. A study by Esra Circi et al., was conducted on effectiveness of extracorporeal shockwave treatment in subacromial impingement syndrome and they concluded that ESWT was found to be effective in the treatment of impingement syndrome both for pain and functional outcome in the early period [9]. Parvaneh Jalilipanah and colleagues conducted a study to investigate the impact of dry needling (DN) and muscle energy technique (MET), both individually and in combination, on patients with shoulder impingement syndrome and active trigger points in the infraspinatus muscle. The research found that the application of DN, MET, and their combination effectively reduced pain, increased pressure pain threshold (PPT), and improved shoulder range of motion (ROM) in individuals with shoulder impingement syndrome. Both techniques proved to be effective in treating trigger points, yet DN demonstrated superior efficacy in enhancing flexion and abduction ROM [10].

CONCLUSION

In conclusion, following a four-week rehabilitation program, notable advancements were observed across various functional domains, including marked reductions in pain, enhanced joint range of motion, and improved muscle strength. Symmetry was achieved, with the right scapula now positioned no higher than its left counterpart. The promising outcomes of the four-week

rehabilitation program suggest potential future advancements through long-term follow-up studies, comparative effectiveness trials, multidisciplinary collaboration, and patient-centric approaches.

Funding– NIL

Informed Consent– Informed consent was obtained from the patient's mother included in the study.

Author's Contribution– All authors contributed equally to the study.

Conflict of Interest– The authors declare that they have no conflict of interest.

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How to Cite;

Kini NN, Gulrandhe P (2024) Effect of Extracorporeal Shock Wave Therapy and Dry Needling in Treatment of Impingement Syndrome. Eur J Ther. 30(1):91-95. https://doi.org/10.58600/eurjther1996

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):96-100.
https://doi.org/10.58600/eurjther1846

Technical Notes

A Modified Technique of Laparoscopic Closed-Entry by the Veress Needle: A Novel, Unique, Rapid, and Simple Procedure

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Received: 2023-09-08 **Accepted**: 2023-09-20 **Published Online**: 2023-09-20

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The retraction that has been published can be accessed via the following link; https://doi.org/10.58600/eurjther2036

RETRACTED ARTICLE

ABSTRACT

Background: Gynecologists usually perform the laparoscopic closed-entry technique to access the intraperitoneal cavity, while general surgeons prefer the open-entry approach, which takes more time. This study aims to introduce and discuss the novel modified closed laparoscopic entry technique. This method involves cutting the fascia after the skin incision to allow only the Veress needle to enter, thus avoiding complications arising from the closed procedure. This approach may benefit safe and quick laparoscopic entry, especially for obese patients.

Method of Technique: The current approach, which we call the modified closed Veress technique (MCVT), is a modification of the previously defined Veress needle entrance method. After the skin is cut, the subcutaneous fat tissue is released with the Mosquito clamp, the muscular fascia is held and hung with the Kocher clamp, and the incision is created large enough to insert the Veress needle. Then, the Veress needle is passed through the parietal peritoneum, the final step before reaching the intraperitoneal cavity.

Results: In our Gynecology and Obstetrics clinic, the current technique for the first entrance to the intraperitoneal cavity was used in a total of 294 patients between the years 2019-2023. There were no intraoperative or postoperative complications associated with the current approach. Moreover, in 12 patients who failed with the standard closed technique, intraperitoneal gas charging was provided in the first trial with the MCVT.

Conclusion: Because it is possibly as safe as the open technique and as quick as the standard closed technique, the MCVT may be one of the alternative techniques for the first laparoscopic entry into the peritoneal cavity to prevent complications and save time. Nevertheless, more thorough and patient-based prospective randomized research is required on this topic.

Keywords: laparoscopic procedure, laparoscopic techniques, trocar insertion, umbilical port, Veress needle

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INTRODUCTION

Laparoscopy is a frequent procedure in gynecological surgery to access the intraabdominal cavity through a small incision [1]. In contrast to typical open surgery, surgeons may not witness the first entry into the peritoneal cavity; consequently, most complications occur during this stage [2]. Although many different entry approaches have been reported, only two techniques are directly accepted as standard practice. First, the Hasson technique, generally known as the open procedure, involves creating a small umbilical incision under

visual inspection to access the intraabdominal cavity and then inserting a blunt trocar into it [3]. The process of first trocar insertion into the abdominal cavity with the Hasson open technique is completed in three to ten minutes [4]. The second is the closed-entry technique by the Veress needle-assisted or direct trocar-inserted. The Veress needle-assisted closed-entry procedure involves making a small incision in the skin with a scalpel and then inserting the needle directly into the peritoneal cavity until it makes a double-click sound. Once the Veress needle insertion has been completed into the peritoneal cavity, gas incubation is provided sufficiently. Finally, the first trocar is penetrated bluntly from the anterior abdominal wall to the level of cutting the fascia, muscle layers, and peritoneum, respectively [5]. In the Veress needle-assisted closed-entry technique, the first trocar insertion into the abdominal cavity is completed approximately 2-4 minutes [6]. Furthermore, the closed-entry technique by direct trocar is generally operated to reduce the entrance period and to identify possible early complications [7]. Although crucial vascular injuries are more prevalent in closed-entry laparoscopic procedures [8], visceral organ or minor vascular injuries are more frequent for open-entry technique, especially in the first trocar insertion [9].

Our Veress needle-assisted modified laparoscopic closed-entry technique, called the MCVT, was developed to prevent possible laparoscopic-entry complications and enter the intraperitoneal cavity more swiftly.

Surgical Technique and Patients

The MCVT is a modified version of the previously defined technique of laparoscopic closed-entry by the Veress needle. In the MCVT, the first of the two subcutaneous anterior abdominal layers may be incised safely; consequently, the remaining single peritoneal layer may be passed by the Veress needle with minimal force under the fascia.

The skin was incised approximately 8 mm from the inferior umbilicus to the caudal with the help of a scalpel number 11 (Figure-1). The subcutaneous fat tissue was dissected with the Mosquito clamp, and the muscular fascia was observed (Figure -2). After this stage, the grasping side of the Kocher clamp was opened parallel to the patient, and the fascia of the umbilicus was clamped and suspended up (Figure -3). Furthermore, an approximately 2 mm incision that was enough to insert the Veress needle at a 3 mm inferior from the muscular fascia suspended by the Kocher clamp was created by the number 11 scalpel (Figure-4). The Veress needle was moved into the intraperitoneal cavity using minimal strength through the incision; moreover, the insufflation of gas was performed after a single click sound that only pierced the parietal peritoneum (Figure -5). Finally, sufficient gas insufflation was achieved, the trocar was safely inserted into the abdomen, and the laparoscope was positioned.

Video 1. https://eurjther.com/index.php/home/article/view/1846/1452

A history of lower abdominal surgery, the status of pregnancy, not being in adulthood, and having a short distance between the anterior abdominal wall and the spine are the reasons for preference for the open-entry procedure. Nevertheless, the open-entry technique's efficacy is often limited due to the lateness of entry time, difficulty in pneumoperitoneum practice or maintenance, and obesity [7]. The history of a surgical mesh below the umbilicus was the only exclusion criterion for the MCVT approach in the current study. Finally, MCVT was performed on 294 cases in our clinic, and informed consent was approved for all included patients. This current study was carried out regarding the ethical standards of the Declaration of Helsinki guidelines.

RESULTS

The MCVT was performed on 294 cases between 2019-2023 in Gaziantep University Faculty of Medicine, Department of Gynecology and Obstetrics. The peritoneal cavity was entered in the first attempt by MCVT; further, there were no first-entry complications such as major vascular trauma or visceral organ injury for any included patients. Moreover, the standard Veress needle-assisted closed-entry technique for the first two attempts failed in 12 patients; on the other hand, the third attempt of these patients was successful with the MCVT approach, and then gas insufflation was provided to the intraperitoneal cavity.

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The retraction that has been published can be accessed via the following link; https://doi.org/10.58600/eurjther2036

The retraction that has been published can be accessed via the following link; https://doi.org/10.58600/eurjther2036

Figure 1. Skin incision

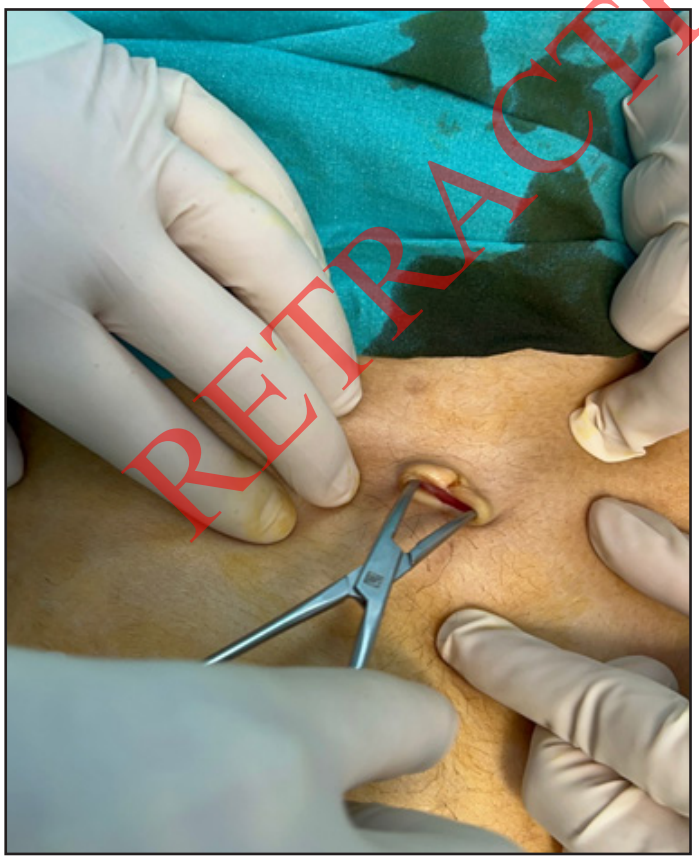

Figure 2. Removal of subcutaneous tissue

Figure 3. Retention of umbilical fascia with Kocher Clamp

Figure 4. Minimal incision to the suspended fascia

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Figure 5. Entering the intraperitoneal cavity through the incision made in the fascia with a Veress needle

DISCUSSION

The mean insertion period of the first trocar into the intraperitoneal location with MCVT was 80 seconds in the study, which was advantageous compared to other traditional techniques. In addition, the MCVT's possible advantages over the standard closed approach were reducing complications such as retrying in the failure of first entry into the peritoneal cavity, major vascular trauma, and visceral organ injury. In the standard closed-entry technique by the Veress needle-assisted, the needle may not pass through the muscular fascia or the peritoneum on the first try, particularly for obese patients [10]; thus, the gas may accumulate in the subcutaneous tissue or peritoneum after insufflation. The failed Veress needle insertion efforts induce not only the development of complications but also increased rates of failed re-entry [11] A second attempt may be performed with MCVT in subcutaneous or peritoneal gas accumulation cases due to a failed first-entry experimentation. Because the muscular fascia incision was made too close to the final peritoneal layer in MCVT, the Veress needle may reach comfortably into the abdominal cavity by only passing one of the peritoneum layers. Consequently, the MCVT is frequently performed in our clinic because of advantages on the first attempt, such as faster and safer entering than the standard closed-entry technique, particularly in obese patients.

A single-center design and the insufficient number of included patients regarding the general population representation were limitations of the current study. Although the last layer of the peritoneum that opens into the abdominal cavity can be passed with minimal effort with MCVT, the sight of the intra-peritoneum may not be distinctly visible during the insertion of the Veress needle. Furthermore, the risk of complications is high in patients with internal organ adhesion to the anterior abdominal wall because of their previous surgery [2, 10, 11]. There were no complications in any cases in the current study; however, possible complications can develop in subsequent patients. Moreover, the Veress needle insertion region may be examined by ultrasonography for adhesions of intraabdominal tissue. Accordingly, the intraoperative ultrasonographic examination of the insertion area can be performed first to avoid some possible complications of MCVT. In the current study, some cases with suspected adhesions under the umbilicus had an ultrasonographic re-examination before MCVT.

CONCLUSION

The MCVT, a synthesis of other procedures, may be an alternative technique for the first entry trial into the peritoneal cavity in laparoscopy to avoid complications and save time. However, more comprehensive and patient-based prospective randomized research on this subject is highly required.

Conflict of interest: None.

Acknowledgments: The authors declared no acknowledgement.

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RETRACTED ARTICLE

The retraction that has been published can be accessed via the following link; https://doi.org/10.58600/eurjther2036

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RETRACTED ARTICLE

The retraction that has been published can be accessed via the following link; https://doi.org/10.58600/eurjther2036

European Journal of Therapeutics
pISSN: 2564-7784
eISSN: 2564-7040

Eur J Ther. 2024;30(1):101.
https://doi.org/10.58600/eurjther2036

RETRACTION

Retraction Note: A Modified Technique of Laparoscopic Closed-Entry by the Veress Needle: A Novel, Unique, Rapid, and Simple Procedure

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Published Online: 2024-02-08

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Retraction Note to:
European Journal of Therapeutics (2024). https://doi.org/10.58600/eurjther1846

The authors request the withdrawal of the technical research paper titled *"A Modified Technique of Laparoscopic Closed-Entry by the Veress Needle: A Novel, Unique, Rapid, and Simple Procedure"* which was published in the Eur J Ther [1]. This request is made on behalf of all authors involved. The authors regret that the reason for retraction was that a conflict of interest arose between them. Consequently, the conflict of interest made the manuscript unsuitable for publication in its current form. The authors apologize for any inconvenience this may cause.

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