

Use of Alloplastic Total Joint Replacement of the Temporomandibular Joint of Growing Patients: A Scoping Review

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Received: 2024-04-19

Accepted: 2024-05-12

Published Online: 2024-05-13

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ABSTRACT

Temporomandibular joint (TMJ) disorders pose unique challenges in pediatric patients undergoing craniofacial growth. Alloplastic total temporomandibular joint reconstruction (TMJR) techniques have emerged as promising solutions, offering immediate joint function and symptom relief. However, the efficacy and safety of TMJR in this population remain under scrutiny. This scoping review aims to comprehensively summarize the evolving literature on TMJR in growing patients with end-stage TMJ pathology. Our methodology adhered to PRISMA-ScR guidelines, identifying 9 relevant articles. The discussion emphasizes preoperative considerations, treatment selection criteria, and potential complications. While TMJR offers short-term benefits, concerns regarding long-term outcomes persist, necessitating further research. Collaboration among multidisciplinary teams is crucial for optimal patient care. Future research should focus on comparative efficacy and safety, refining treatment algorithms, and long-term follow-up to enhance outcomes and minimize complications in pediatric TMJ pathology.

Keywords: TMJ total joint replacement; TMJ surgery; TMJR; growing patient; skeletally immature

INTRODUCTION

Temporomandibular joint disorders (TMD) present unique challenges in pediatric patients, particularly those with

ongoing craniofacial growth. Surgical management options for temporomandibular joint (TMJ) pathology in growing patients have evolved over the years, with a shift towards the utilization of

alloplastic total temporomandibular joint reconstruction (TMJR) techniques. Alloplastic materials offer the advantage of providing immediate joint function and alleviating symptoms associated with TMD. However, their efficacy and safety in the growing patient population remain topics of debate and investigation.

Several key studies have contributed to our understanding of TMJR in growing patients. Sinn *et al.* [1] conducted a preliminary investigation into the feasibility of TMJR in the growing patient population, shedding light on potential outcomes and considerations. Similarly, Hechler and Matthews [2] examined the role of alloplastic TMJ reconstruction specifically in patients with juvenile idiopathic arthritis, highlighting the unique challenges and benefits in this subset of patients.

Mercuri and Swift [3] provided valuable insights into the considerations for using alloplastic TMJ replacement in growing patients, addressing factors such as growth potential, adaptation, and long-term outcomes. Furthermore, Keyser *et al.* [4] conducted a pilot survey investigating the outcomes of TMJR in skeletally immature patients, contributing valuable data to the existing literature.

Case reports and small case series have also provided valuable insights into the clinical application of TMJR in growing patients.

Main Points:

- TMD poses a significant challenge in pediatric patients, specially ongoing craniofacial growth.
- Conditions such as JIA and ankylosis commonly affect the craniofacial imbalance and TMJR are considered a feasible choice for treatment.
- TMJR offer effective relief from chronic pain associated with end-stage TMJ pathology, thereby improving patient comfort and QoL. It also provides restoration of function to normal jaw function, facilitating chewing, speaking, and swallowing, thereby enhancing OOH and function.
- TMJR demonstrate long-term stability, but the need for revision surgery may arise in cases of implant failure, infection, or development of new TMJ pathology. Skeletally immature patients may require reoperation to accommodate ongoing craniofacial growth and development and address any skeletal discrepancies that arise over time.

Cascone *et al.* [5] reported on TMJ replacement utilizing patient-fitted devices in a child with re-ankylosis, demonstrating the feasibility and potential benefits of this approach. Similarly, Goker *et al.* [6] presented a case report on custom-made alloplastic TMJ replacement in an immature patient, highlighting individualized treatment options.

Resnick's article discusses the challenges and considerations associated with temporomandibular joint reconstruction in pediatric patients. It explores various surgical techniques and treatment modalities for managing TMJ pathology in growing children, emphasizing the importance of individualized treatment planning and careful consideration of growth factors. The article highlights the complexity of TMJR in pediatric patients due to ongoing craniofacial growth and development, emphasizing the need for long-term follow-up to assess treatment outcomes and monitor for potential growth disturbances [7].

Zimmerer *et al.* [8] explores the use of patient specific TMJR as an approach to treating congenital mandibular hypoplasia and complex craniofacial anomalies. Through a detailed analysis of patient cases, the study demonstrated the feasibility and effectiveness of this approach in restoring jaw function and improving facial aesthetics. In addition to clinical studies and case reports, systematic reviews have synthesized existing evidence on the use of TMJR in growing patients with end-stage TMJ pathology. Khattak *et al.* [9] conducted a systematic review to evaluate the success rates and outcomes of TMJR in this population.

Overall, the literature regarding TMJR in growing patients with TMJ pathology is evolving rapidly, with emerging evidence shaping clinical practice and decision-making. This scoping review aims to provide a comprehensive overview of the current literature regarding the use of TMJR in growing patients with end-stage TMJ pathology. By synthesizing evidence from recent studies and clinical reports, we seek to elucidate the role of TMJR in managing end-stage TMJ disorders in pediatric and adolescent populations.

MATERIALS AND METHODS

The data presented in this article was gathered by thoroughly examining existing literature, adhering to PRISMA-ScR guidelines. [10] A specific search strategy was implemented by two independent reviewers (BCL and RG), who searched online databases such as PubMed, Scopus, and Web of Science

(WoS). This strategy included keywords like “TMJ total joint replacement”; “TMJ surgery”; “TMJ reconstruction” and “growing patient”. All studies related to reconstructive surgery with TMJR in growing patients, except books, were considered. Additionally, a manual search of databases was conducted to identify potentially missed articles by reviewing the references of included articles. There were no language or publication year restrictions.

Titles and abstracts of search results were meticulously evaluated for relevance. Selected articles underwent full-text screening, during which authors thoroughly examined and extracted

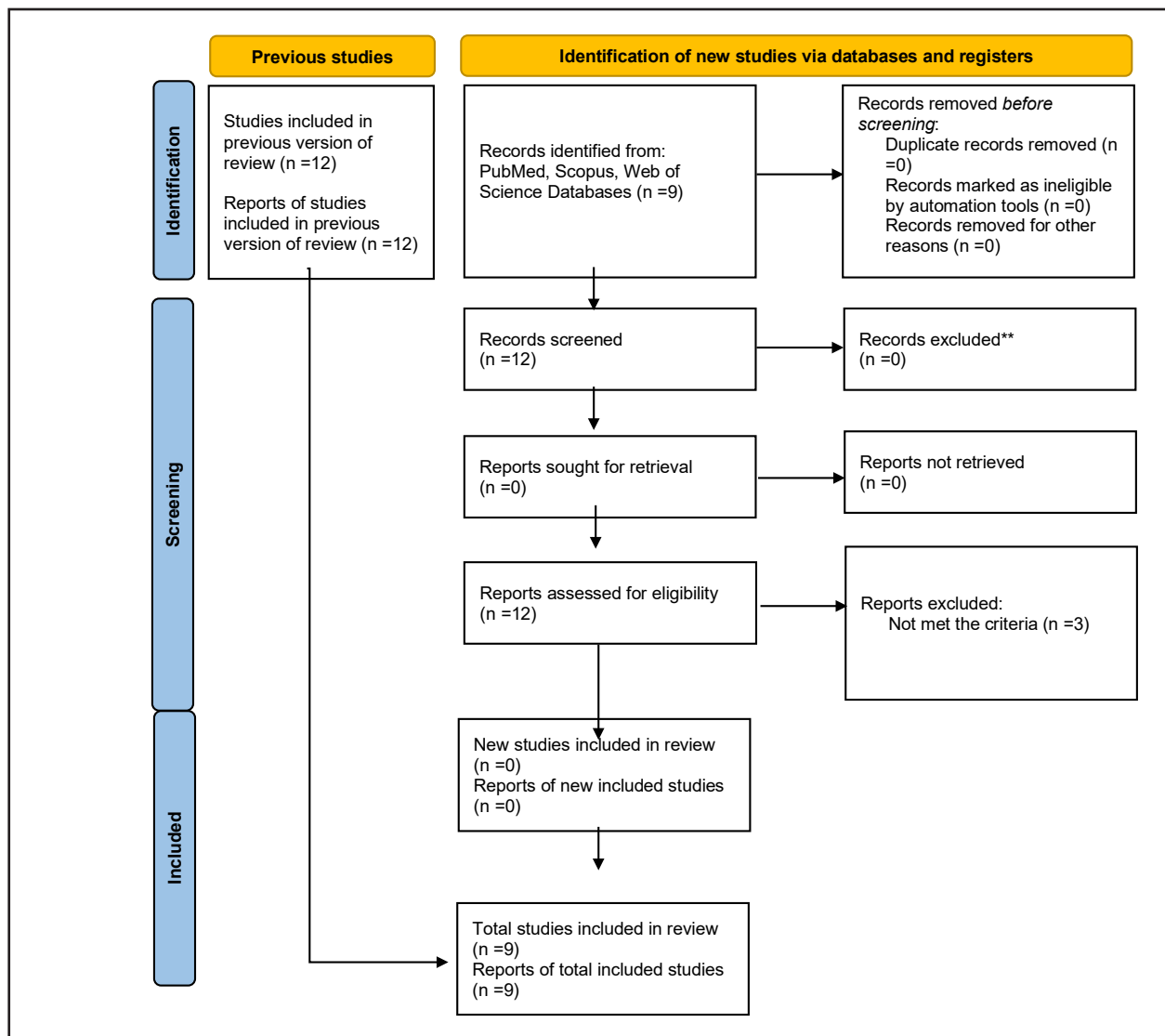
relevant data.

This study critically reviewed publicly available electronic sources and did not involve specific patient information, thus exempting it from institutional review board approval.

RESULTS

A total of 9 articles were identified that met the screening criteria. We accessed the use TMJR in reconstruction of growing patients and brought to discussion along with other renowned articles in the literature. The PRISMA flow of selection of articles was presented in Table 1.

Table 1. PRISMA 2020 flow diagram for updated systematic reviews which included searches of databases and registers only



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

DISCUSSION

Prior to undergoing TMJR, patients in the included studies were diagnosed with various TMJ pathologies, including degenerative joint disease, ankylosis, severe condylar resorption, and inflammatory arthritis. Preoperative diagnostic modalities often included clinical examination, imaging studies (e.g., MRI, CT), and functional assessments to evaluate TMJ function and severity of disease. The decision to select TMJR as the treatment modality for TMJ pathology in growing patients was influenced by several factors, including the severity of disease, patient age, growth potential, and treatment goals. In cases where conservative measures failed to provide symptomatic relief or preserve TMJ function, TMJR was considered as a viable option to restore joint function and alleviate pain. Additionally, in patients with congenital anomalies or developmental disorders affecting mandibular growth, TMJR offered a reconstructive solution to address functional deficits and optimize craniofacial development.

TMJ prostheses offer effective relief from chronic pain associated with end-stage TMJ pathology, thereby improving patient comfort and quality of life [3,11]. It also provides restoration of function to normal jaw function, facilitating chewing, speaking, and swallowing, thereby enhancing overall oral health and function [4,12,13].

By restoring normal joint anatomy and function, TMJ prostheses help prevent growth disturbances and asymmetries in skeletally immature patients [1]. The restoration of normal jaw function and facial symmetry enhances the aesthetic appearance of patients with TMJ pathology, boosting self-esteem and confidence [14]. Advances in technology allow for the customization of TMJ prostheses to match the patient's unique anatomical and physiological characteristics, optimizing surgical outcomes [6,15].

Also, patient-specific TMJ prostheses demonstrate long-term stability and durability, reducing the need for revision surgery, providing lasting relief from TMJ-related symptoms and functional limitations [5,12,13].

While some studies have focused on the efficacy of TMJR in pediatric patients with various TMJ pathologies, there remains a lack of consensus regarding its long-term outcomes and potential complications in this population. Limited long-term follow-up data exist to evaluate the durability and functional outcomes of TMJR in growing patients, raising concerns about

the appropriateness of this treatment modality in this age group.

Due to its surgical complexity, TMJR surgery in growing patients is technically challenging and requires specialized training and expertise [3,15].

Also, implantation of TMJ prostheses may interfere with mandibular growth and development, leading to skeletal discrepancies [9,11,12]. Along with this, there are risks of complications such as infection, implant failure, and malocclusion may occur following TMJ replacement surgery, necessitating careful patient monitoring and management [4,15].

The major concern about TMJR in juveniles is the long-term success of the implantation. Long-term follow-up is one of the baselines in the realm of TMJR [12,13]. Data on the outcomes and complications of TMJ prostheses in growing patients are lacking, limiting the ability to predict their efficacy and safety over time [1]. The available literature on long-term outcomes of TMJR in pediatric and adolescent patients is limited and predominantly consists of case reports and small case series. Robust evidence regarding the longevity, adaptability, and patient satisfaction with TMJR in this population is lacking, necessitating further prospective studies with larger sample sizes and longer follow-up periods to elucidate the true efficacy and safety profile of this treatment modality.

The decision to undergo TMJR in pediatric patients should be weighed carefully against alternative treatment options, such as autogenous tissue grafting or conservative management strategies. While TMJR may offer advantages in terms of joint function restoration and pain relief, its utilization in growing patients carries inherent risks, including potential interference with mandibular growth and development, implant failure, and the need for revision surgery in the future [7].

The short-term outcomes of TMJ prostheses demonstrate favorable in terms of pain relief, restoration of function, and patient satisfaction [11,15]. The long-term predictability of TMJ prostheses in growing patients remains uncertain, highlighting the need for further research and long-term follow-up studies, [9] but certainly it has proved to have a long-term stability in skeletally mature subjects [12,13].

Autogenous tissue grafts, such as costochondral grafts, have shown potential for growth and adaptation, which is crucial

in pediatric patients. However, unpredictable growth patterns and overgrowth have been reported with costochondral grafts, posing challenges in achieving optimal functional and aesthetic outcomes [7].

Patients with end-stage TMJ pathology are the best candidates for TMJ replacement surgery, especially those with severe and refractory TMJ pathology that is unresponsive to conservative management [3,12,13]. Patients experiencing significant functional impairment, including limited mouth opening, malocclusion, and difficulty chewing, may benefit from TMJ prostheses [4,12,13]. TMJR offer significant improvements in pain relief, jaw function, and overall quality of life, allowing patients to resume normal activities and social interactions, [3,12,13] not mentioning that facial symmetry enhances the aesthetic appearance of patients with TMJ pathology, boosting self-esteem and confidence [6].

The timing of TMJ replacement surgery must be carefully considered to minimize the risk of growth disturbances and optimize long-term outcomes [3,7]. Besides that, the close collaboration between oral and maxillofacial surgeons, orthodontists, and pediatric specialists is essential to ensure comprehensive treatment planning and optimal patient care [4,16]. Treatment planning should be tailored to the patient's specific clinical presentation, etiology of TMJ pathology, and anatomical considerations [1,12,13].

Long-term follow-up studies have provided insights into the outcomes of different surgical techniques. Autogenous tissue grafts, despite their potential for growth, may present complications such as fracture or unpredictable growth, as evidenced by long-term studies [7]. For TMJR, this is not different. Close postoperative monitoring is necessary to assess the patient's progress, detect any complications early, and adjust the treatment plan as needed [3,11].

Patients and caregivers should receive comprehensive education regarding postoperative care, including dietary modifications, oral hygiene practices, and signs of potential complications [1,12,13]. Physical therapy and jaw exercises may be prescribed to promote optimal healing and functional outcomes following TMJ replacement surgery [4,16].

While TMJ prostheses demonstrate long-term stability, the need for revision surgery may arise in cases of implant failure,

infection, or development of new TMJ pathology [5,12,13]. Skeletally immature patients may require reoperation to accommodate ongoing craniofacial growth and development and address any skeletal discrepancies that arise over time [1,3,7].

CONCLUSION

Future research should aim to elucidate the comparative efficacy, safety, and long-term outcomes of TMJR compared to other treatment modalities in pediatric patients with TMJ pathology. Collaboration between multidisciplinary teams comprising oral and maxillofacial surgeons, orthodontists, rheumatologists, and pediatric specialists is crucial to optimize treatment outcomes for this patient population.

The utilization of TMJR in growing patients with end-stage TMJ pathologies represents a valuable therapeutic option, offering the potential for significant improvements in pain relief, jaw function, and quality of life. However, careful patient selection, meticulous preoperative planning, and long-term follow-up are paramount to ensuring favorable outcomes and minimizing the risk of complications. Further research is warranted to elucidate the long-term efficacy and safety of TMJR in pediatric populations and to refine treatment algorithms to optimize patient care and surgical outcomes.

Funding: This article was not supported by any grant.

Competing interests: There are no conflict of interest.

Authors contribution: All authors contributed equally to this manuscript. All authors read and approved the final manuscript.

Acknowledgement: During the preparation of this work the authors used ChatGPT to translate parts of the manuscript. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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How to Cite;

Correia Lima B, Grillo R, Alvarez Quinta Reis B, Peral Ferreira Pinto LA, Melhem-Elias F (2024) Use of Alloplastic Total Joint Replacement of the Temporomandibular Joint of Growing Patients: A Scoping Review. *Eur J Ther.* <https://doi.org/10.58600/eurjther2152>