



Technical approaches and clinical outcomes of the treatment of temporomandibular dysfunction with prostheses: a systematic review

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Abstract

Introduction: Temporomandibular joint (TMJ) replacement is usually a last resort in the surgical treatment of end-stage joint disease. For all this gear to work efficiently, occlusion, articulation, musculature, ligaments, and psychological factors must be in complete harmony. As a treatment, implantation of a total alloplastic TMJ prosthesis. **Objective:** It was to demonstrate, through a systematic review, the main considerations and clinical outcomes of the treatment of temporomandibular disorders with different types of prostheses. **Methods:** The systematic review rules of the PRISMA Platform were followed. The search was carried out from February to April 2023 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases, using articles from 2013 to 2023. **Results and Conclusion:** A total of 127 articles were found, 60 articles were evaluated and 31 were included and developed in this systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 12 studies with a high risk of bias and 33 studies that did not meet GRADE. Based on the results, temporomandibular disorders (TMD) treatment is diverse and depends on the type of disease, as well as the duration and subjective level of pain. Alloplastic reconstruction can be advantageous in obtaining a rapid improvement in symptoms and rapid rehabilitation of masticatory function. Treatment of functional TMD is commonly based on conservative therapy, including physical therapy, pain therapy, and splinting therapy. Depending on the severity of TMD, treatment varies according to the degree of surgical invasion. Thus, the TMJ prosthesis seems to be reserved for patients with

persistent pain, bone or fibrous ankylosis, or osteomyelitis after primary closed or open treatment of mandibular condyle fractures. Quality of life, mouth opening, and daily eating improved significantly after total TMJ prosthesis.

Keywords: Temporomandibular joint.
Temporomandibular disorder. Surgical treatments.
Prostheses.

Introduction

Temporomandibular joint (TMJ) replacement is usually a last resort in the surgical treatment of end-stage joint disease. The prerequisite for consideration of TMJ is the failure of conservative treatment [1]. Indications for TMJ replacement have been established by the UK. In this context, the TMJ, being the only mobile joint in the skull, is one of the most complex structures to study, this joint allows rotation and translation movements, this occurs due to its double joint next to the condyle and its condylar cavity [1,2]. For all this gear to work efficiently, occlusion, articulation, musculature, ligaments, and psychological factors must be in complete harmony. Habits such as biting objects, straining the jaw, sleeping awkwardly, or exerting any tension that is not natural to the jaw [1-3].

In this sense, the TMJ can be affected by end-stage pathologies, such as arthritic disease, trauma, and ankylosis. The main debilitating symptoms result in limited mouth opening and pain [4,5]. The TMJ prosthesis is indicated for diseases that result in anatomical changes and aims to restore joint function with pain relief. Prosthetic replacement for terminal TMJ

disease is gradually becoming a common procedure due to good functional results and low morbidity [6]. Significant advances have been made in the design of temporomandibular joint prostheses during the last few decades, especially thanks to the use of 3D printing [7].

In this context, the term Temporomandibular Disorder (TMD) is used to describe TMJ diseases that may be related to the joint, musculature, ligaments, bone, tooth, and psychological aspects. However, TMD can be divided into two large subgroups, those originating from joint problems, that is, those in which the signs and symptoms are related to the TMJ, and those of muscular origin, where their relationship is associated with the structures of the stomatognathic system [6,7].

Also, patients with TMD often suffer from chronic pain, but severe pain can lead to a reduced quality of life. According to studies, about 60-70% of the general population has suffered from at least one symptom of this disorder at some stage of life; however, only about 5% of them seek treatment. Still, TMD has a very broad interpretation and represents a population that has been suffering from muscle and/or joint pain. When installed, it represents joint pain in the TMJ and/or muscle and, given this panorama, it is observed that the most affected population is the female sex, in a ratio of 4:1 [8].

Thus, as a treatment, the implantation of a total alloplastic temporomandibular joint (TMJ) prosthesis is an innovative approach to the treatment of end-stage TMJ disorders. There are two types of prefabricated (stock) and custom computer-aided design/computer-aided manufacturing (CAD/CAM) systems [9,10].

Given the above, the present study aimed to demonstrate, through a systematic review, the main considerations and clinical outcomes of the treatment of temporomandibular disorders with different types of prostheses.

Methods

Study Design

This was followed by a systematic literature review model, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) rules. Available in: <http://prisma-statement.org/?AspxAutoDetectCookieSupport=1>. Accessed in: 05/22/2023.

Data sources and research strategy

The literary search process was carried out from February to April 2023 and was developed based on Scopus, PubMed, Science Direct, Scielo, and Google Scholar, using articles from 2013 to 2023, using the

descriptors (MeSH Terms): "Temporomandibular joint. Temporomandibular dysfunction. Surgical treatments. Prostheses", and using the Booleans "and" between the descriptors (MeSH Terms) and "or" between the historical findings.

Study Quality and Risk of Bias

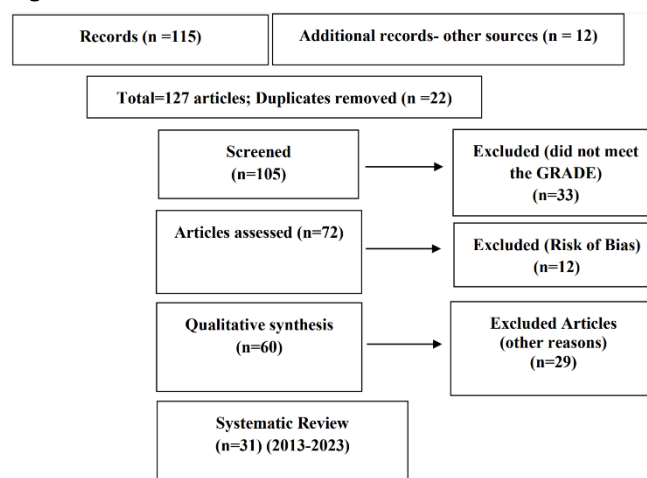
The quality of the studies was based on the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument.

Results

Summary of Literary Findings

A total of 127 articles were found. Initially, duplication of articles was excluded. After this process, the abstracts were evaluated and a new exclusion was performed, removing the articles that did not include the theme of this article, resulting in 72 articles. A total of 60 articles were evaluated and 31 were included and developed in this systematic review study (Figure 1). Considering the Cochrane tool for risk of bias, the overall assessment resulted in 12 studies with a high risk of bias and 33 studies that did not meet GRADE.

Figure 1. Selection of studies.



Major Results

A study carried out a systematic review and meta-analysis on the TMJ prosthesis as a treatment option after fracture of the mandibular condyle. A total of 337 studies were included (121 case reports, 89 case series, and 127 cohort/clinical studies). In total, 14,396 patients and 21,560 prostheses were described. The meta-analysis showed a pooled prevalence of condylar fracture of 1.6% (95% confidence interval 0.9-2.4%) and a pooled prevalence of trauma or condylar fracture of 11.3% (confidence interval from 95% 7.1-16.0%). The TMJ prosthesis seems to be reserved for patients with persistent pain, bone or fibrous ankylosis, or

osteomyelitis after primary closed or open treatment of mandibular condyle fractures [11].

TMD can manifest itself in the chewing muscle, the TMJ, the ear, the mouth, the tooth, and the skull. The alteration in the masticatory muscles caused by TMD is characterized by pain associated with the soft and hard tissues of the head, face, neck, and other intraoral structures [12]. The etiology is multifactorial and TMJ problems can be divided into muscle disorders, and joint disorders, with muscle disorders affecting masticatory muscles including myofascial pain, myositis, and trismus, while joint pain encompasses problems that occur within the joint capsule, and these changes are in the shape of the joint surfaces due to the remodeling of the articular disc surfaces causing disc displacements [13].

Added to this, TMD has a direct impact on the lives of people who are affected by this type of injury. This pain affects the daily life and work activities of these people, reducing their quality of life and productivity. Other problems that may occur are ear pain, a feeling of ear fullness, a feeling of decreased hearing acuity, tinnitus, dizziness, and vertigo [14].

There may also be limitations of mandibular movements, abnormal static and dynamic occlusion, and there may also be the presence of joint noises (such as clicking and/or crepitation) [14]. The click may or may not occur with pain and with the double click when opening and closing the mouth, which characterizes as displacement of the joint disc with possible reduction, and the asymptomatic silent joint with limitation of mouth opening is an indication of a possible displacement of the articular disc without reduction. And when there is a recurrent cryption it is indicative of arthrosis. For a correct and accurate diagnosis of TMD, and correct treatment, the evaluation of all the symptoms aligned with teamwork is essential for the success in the treatment of TMD, in which each professional will act in his/her area of competence [15].

In this scenario, the stomatognathic system (SE) is extremely important in the physiological interconnection with its constituent elements and the central nervous system (CNS), and the proprioceptors present in soft tissues, muscles, temporomandibular joint and the periodontal membrane. Interference can lead the masticatory muscles to adjust their function to protect the SS, leading the mandible to a position with different dental contacts, which may cause damage to the TMJ. These damages can generate parafunction or temporomandibular dysfunction (TMD) [15,16].

In this regard, two different types of prostheses for total prosthetic joint replacement of TMJ (total prosthetic joint replacement, TJR system) are available, the stock system and custom computer-aided

design/computer-aided manufacturing (CAD/CAM systems). While stock devices are prefabricated and available in different standard shapes and standard sizes, each CAD/CAM component is manufactured using the individual patient's DICOM (Digital Imaging and Communications in Medicine) data. This system is designed for the specific patient situation and should provide a perfect fit. However, the communicating articular surfaces of the fossa and condyle of the implant are standardized, as in the stock system [17-22].

In this regard, the treatment of TMD is diverse and depends on the type of disease, as well as the duration and subjective level of pain. Alloplastic reconstruction can be advantageous in obtaining a rapid improvement of symptoms and rapid rehabilitation of masticatory function [23]. The treatment of functional TMD is commonly based on conservative therapy, including physiotherapy, pain therapy, and splinting therapy [24]. Depending on the severity of TMD, treatment varies according to the degree of surgical invasion. An effective method to achieve rapid improvements in mouth opening and pain reduction is TMJ reconstruction using an alloplastic total prosthetic joint replacement (PJR) [25-28]. This invasive approach is still considered the last resort for the treatment of TMD [29]. Complete resection of the diseased joint and implantation of a fossa and condyle component is an invasive and irreversible procedure. There are clear indications for the use of a PJR TMJ, for example, diseases involving bone loss and conservative treatment failure, restricted mouth opening, occlusal failure, or high levels of pain [15].

Also, a recent systematic review study analyzed the placement of a TMJ prosthesis as a treatment option after a fracture of the mandibular condyle. In total, 14,396 patients and 21,560 prostheses were described. Of the 127 cohorts or clinical studies, 100 (79%) reported inclusion criteria, 54 (43%) reported exclusion criteria and 96 (76%) reported the inclusion period. The base population from which patients were recruited was reported in 57 studies (45%). The reason for implanting a TMJ prosthesis was reported by 4,177 patients (29.0%). A history of condylar fracture was present in 83 patients (2.0%); a history of mandibular trauma was present in 580 patients (13.9%). The meta-analysis showed a pooled prevalence of condylar fracture of 1.6% (95% confidence interval 0.9-2.4%) and a pooled prevalence of trauma or condylar fracture of 11.3% (95% confidence interval % 7.1-16.0%) [30].

Finally, a study carried out by Beret et al. (2022) showed that quality of life, mouth opening, and daily eating significantly improved after total TMJ prosthesis. TMJ prosthesis may be considered earlier in the management of end-stage temporomandibular disease [31].

Conclusion

Based on the results, TMD treatment is diverse and depends on the type of disease, as well as the duration and subjective level of pain. Alloplastic reconstruction can be advantageous in obtaining a rapid improvement in symptoms and rapid rehabilitation of masticatory function. Treatment of functional TMD is commonly based on conservative therapy, including physical therapy, pain therapy, and splinting therapy. Depending on the severity of TMD, treatment varies according to the degree of surgical invasion. Thus, the TMJ prosthesis seems to be reserved for patients with persistent pain, bone or fibrous ankylosis, or osteomyelitis after primary closed or open treatment of mandibular condyle fractures. Quality of life, mouth opening, and daily eating improved significantly after total TMJ prosthesis.

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Informed consent

Not applicable.

Data sharing statement

No additional data are available.

Conflict of interest

The authors declare no conflict of interest.

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