



Main considerations of the temporomandibular joint, its disorders, and treatments: a systematic review

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DOI: <https://doi.org/10.54448/mdnt23S106>

Received: 09-16-2022; Revised: 12-21-2022; Accepted: 01-15-2023; Published: 01-26-2023; MedNEXT-id: e23S106

Abstract

Introduction: The temporomandibular joint (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. 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.

Objective: A concise systematic review was carried out to present the main considerations about the temporomandibular joint, as well as the main clinical results of the treatment of temporomandibular disorders (TMD). **Methods:** The systematic review rules of the PRISMA Platform were followed. The search was carried out from October to December 2022 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases, using articles from 2013 to 2022. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results and Conclusion:** A total of 240 articles were found, 65 articles were evaluated in full and 26 were included and developed in this systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 45 studies with a high risk of bias and 94 studies that did not meet GRADE. It was concluded that the etiology of temporomandibular disorder is multifactorial, with muscle disorders, joint disorders, and muscle disorders affecting mastication muscles. As a treatment, each CAD/CAM component is manufactured using the patient's data. This system is designed for the specific patient situation and should provide a perfect fit. However, the communication of the fossa and condyle

articular surfaces of the implant are standardized, as in the stock system. 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 in symptoms and rapid rehabilitation of masticatory function.

Keywords: Temporomandibular joint. Temporomandibular disorders. Prosthetics. CAD/CAM.

Introduction

The temporomandibular joint (TMJ) being the only mobile joint in the skull is one of the most complex structures to study, as this joint allows rotation and translation movements, this occurs due to its double articulation next to the condyle and its condylar cavity [1]. 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 [2,3].

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. 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. 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 [4].

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 [3,4].

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 [5].

Thus, as a treatment, the implantation of a total alloplastic 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 [6,7].

In this sense, as literary support, 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 [8].

Therefore, the present study aimed to carry out a concise systematic review to present the main considerations of the temporomandibular joint, as well as the main clinical outcomes of the treatment of temporomandibular disorders.

Methods

Study Design

This was followed by a systematic literature review model on the main clinical findings of mandible fractures, according to the PRISMA rules (Transparent

reporting of systematic review and meta-analysis-[HTTP://www.prisma-statement.org/](http://www.prisma-statement.org/)).

Data sources and research strategy

The literary search process was carried out from October to December 2022 and was developed based on Scopus, PubMed, Science Direct, Scielo, and Google Scholar, using scientific articles from 2013 to 2022, using the descriptors (MeSH Terms): "Temporomandibular joint. Temporomandibular disorders. Prosthetics. CAD/CAM", 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, with randomized controlled clinical studies, prospective controlled clinical studies, and studies of systematic review and meta-analysis listed as the studies with the greatest scientific evidence. The risk of bias was analyzed according to the Cochrane instrument.

Results and Discussion

Summary of Findings

A total of 240 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 204 articles. A total of 65 articles were evaluated in full and 26 were included and developed in this systematic review study (**Figure 1**). Considering the Cochrane tool for risk of bias, the overall assessment resulted in 45 studies with a high risk of bias and 94 studies that did not meet GRADE.

Figure 1. Selection of studies

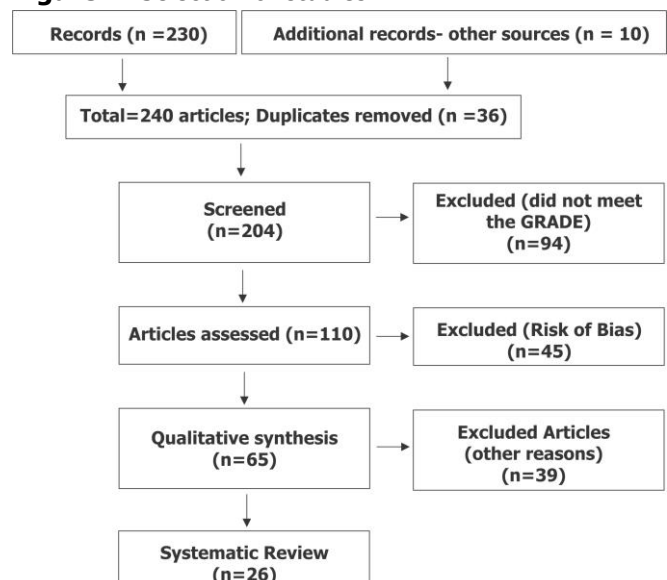
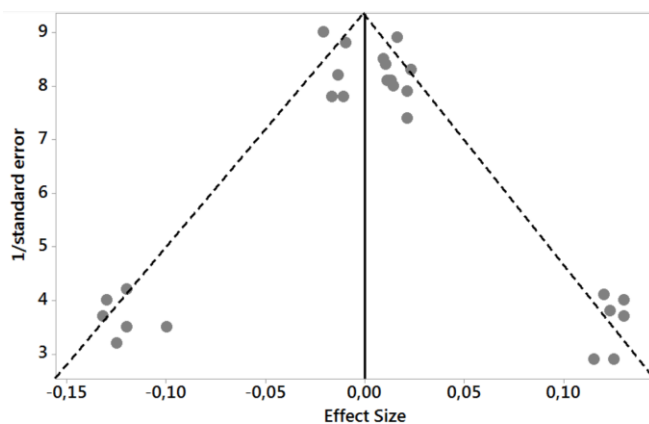


Figure 2 presents the results of the risk of bias in the studies using the Funnel Plot, through the calculation of the Effect Size (Cohen's Test). The sample size was determined indirectly by the inverse of the standard error. The number of clinical studies evaluated was $n=26$. The graph showed symmetric behavior, not suggesting a significant risk of bias in studies with small sample sizes, which are shown at the bottom of the graph.

Figure 2. The symmetric funnel plot does not suggest a risk of bias between the small sample size studies that are shown at the bottom of the graph ($N = 26$ studies).



Source: Own authorship.

Clinical Findings

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 [9]. 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 [10].

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 (otalgia), feeling of ear fullness, feeling of decreased hearing acuity, tinnitus, dizziness, and vertigo [11].

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) [11]. 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 recurrent encryption 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 TMDs, in which each professional will act in their area of competence [12].

In this scenario, the stomatognathic system (SS) 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 (TMJ) 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) [12,13].

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 [14-19].

In this regard, 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 of symptoms and rapid rehabilitation of masticatory function [20].

The treatment of functional TMD is commonly based on conservative therapy, including physiotherapy, pain therapy, and splinting therapy [21]. Depending on the severity of the TMD, the treatment is a 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) [22-25]. This invasive approach is still considered the last resort for the treatment of TMD [26].

In this context, the complete resection of the diseased joint and the implantation of a fossa and a condylar component is an invasive and irreversible procedure. There are clear indications for the use of a PJR for TMJ, for example, diseases involving bone loss and conservative treatment failure, restricted mouth

opening, occlusal failure, or high levels of pain [12].

In general, two different types of prostheses for TMJ total PJR are available, the stock system and custom computer-aided design/computer-aided manufacturing (CAD/CAM systems). While stock devices are pre-made and available in different standard shapes and standard sizes. The CAD/CAM component is fabricated using the individual patient's DICOM (Digital Imaging and Medical Communications) data. The TJR system is designed for the specific patient situation and should provide a perfect fit. However, the communicating articular surfaces of the implant fossa and condyle are standardized, as in the stock system [14].

Conclusion

It was concluded that the etiology of temporomandibular disorder is multifactorial, with muscle disorders, joint disorders, and muscle disorders affecting mastication muscles. As a treatment, each CAD/CAM component is manufactured using individual patient data. This system is designed for the specific patient situation and should provide a perfect fit. However, the communication of the fossa and condyle articular surfaces of the implant are standardized, as in the stock system. The treatment of temporomandibular disorders 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.

Acknowledgement

Not applicable.

Funding

Not applicable.

Ethics approval

Not applicable.

Informed consent

Not applicable.

Data sharing statement

No additional data are available.

Conflict of interest

The authors declare no conflict of interest.

Similarity check

It was applied by Ithenticate@.

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