MedNEXT
Journal of Medical an Health Sciences

REVIEW ARTICLE

DOI: 10.54448/mdnt23S215

Temporomandibular joint and complications in the dental implant: a systematic review

Thaís Alarcon Idalgo[1,2], Antônio Abdoral Soares Neto[1,2], Fabio Alarcon Idalgo[1,2*], Silvio Antonio dos Santos Pereira[1,2], Alexandre Gomes Nunes[1,2], Elias Naim Kassis[1,2], Alvaro José Cicareli[1,2]

[1] UNORTE - University Center of Northern São Paulo, Dentistry department, São José do Rio Preto, São Paulo, Brazil.
[2] UNIPOS - Post graduate and continuing education, Dentistry department, São José do Rio Preto, São Paulo, Brazil.

*Corresponding author: Dr. Fabio Alarcon Idalgo.
Unorte/Unipos – Graduate and Postgraduate education,
Dentistry department, São José do Rio Preto,
São Paulo, Brazil.
Email: dridalgo@gmail.com

DOI: https://doi.org/10.54448/mdnt23S215
Received: 02-18-2023; Revised: 05-31-2023; Accepted: 06-02-2023; Published: 06-05-2023; MedNEXT-id: e23S215

Abstract

Introduction: Surgical procedures in the oral cavity and maxillofacial complex are used to remove pathologies and infections, restore function, optimize occlusal relationships, and prosthetically replace teeth and temporomandibular joints. **Objective:** It was to present, through a systematic review, the main clinical outcomes of the treatment of the temporomandibular joint in the scenario of dental implants and complications. **Methods:** The systematic review rules of the PRISMA Platform were followed. The search was carried out from February to May 2023 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases, using articles from 2018 to 2023. **Results and Conclusion:** A total of 107 articles were found, 37 articles were evaluated and 19 were included and developed in this systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 25 studies with a high risk of bias and 24 studies that did not meet GRADE. It was concluded that for the entire gear of the temporomandibular joint to work efficiently, occlusion, joint, musculature, ligaments, and psychological factors must be in complete harmony. Clinical studies have shown that factors associated with implant placement, such as the long duration of surgical procedures, may represent risk factors for temporomandibular disorders.

Keywords: Dental implant. Complications. Temporomandibular joint. Temporomandibular disorder.

Introduction

Surgical procedures in the oral cavity and maxillofacial complex are diverse and involve multiple tissues exclusive to this region, such as the temporomandibular joints (TMJ) [1]. These procedures are used to remove pathologies and infections, restore function, optimize occlusal relationships, prosthetically replace teeth and temporomandibular joints, improve esthetics, and increase the dimensions of the upper respiratory tract [2].

In this context, the failure of conservative treatment of TMJ is one of the main problems [1]. The TMJ is the only mobile joint in the skull, allowing rotation and translation movements, this is due to its double articulation next to the condyle and its condylar cavity [1,2]. For all this gear to work efficiently, occlusion, joint, musculature, ligaments, and psychological factors must be in complete harmony [1-3]. As a corollary of this, the TMJ can be affected by arthritic disease, trauma, and hookworms - Temporomandibular Disorders (TMD) [4,5]. The TMJ prosthesis is indicated for diseases that result in anatomical changes and aims to restore joint function with pain relief, with good functional results and low morbidity [6], especially thanks to the use of 3D printing [7].

Also, 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, in which their relationship is associated with the structures of the stomatognathic system [6,7], causing chronic pain processes and loss of quality of life. According to studies, about 70% of the general population has already suffered at least one symptom of this disorder at some stage of life, especially since it is observed that the female population is the most affected [8-10].

Thus, the present study aimed to present, through a systematic review, the main clinical outcomes of the treatment of the temporomandibular joint in the setting of dental implants and complications.

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: 04/17/2023.

Data sources and Study Quality and Risk of Bias

The literary search process was carried out from February to May 2023 and was developed based on Scopus, PubMed, Science Direct, Scielo, and Google Scholar, using articles from 2018 to 2023, using the descriptors (MeSH Terms): *"Dental implant. Complications. Temporomandibular joint. Temporomandibular disorder",* and using the Booleans "and" between the descriptors (MeSH Terms) and "or" between the historical findings. 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 107 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 62 articles. A total of 37 articles were evaluated and 19 were included and developed in this systematic review study (**Figure 1**). Considering the Cochrane tool for risk of bias, the overall assessment resulted in 25 studies with a high risk of bias and 24 studies that did not meet GRADE.

Figure 1. Selection of studies.

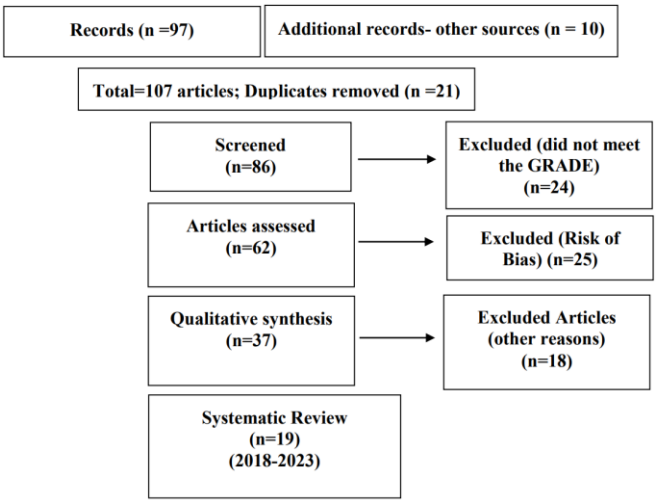
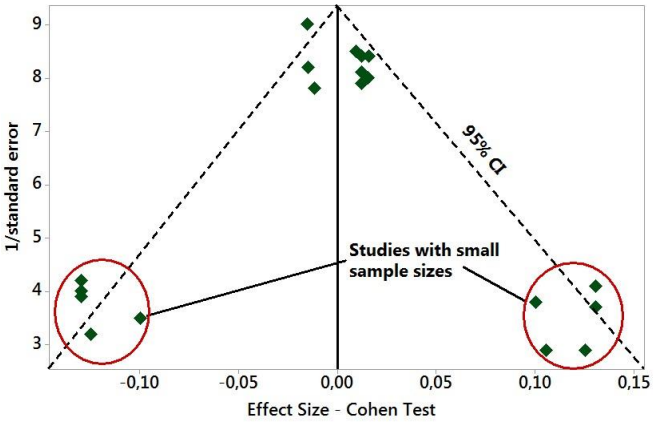


Figure 2 presents the results of the risk of bias in the studies using the Funnel Plot, through the calculation of the Effect Size (Cohen's Test). The sample size was determined indirectly by the inverse of the standard error. The graph showed symmetric behavior, not suggesting a significant risk of 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 = 19 studies (2018-2023).



Source: Own authorship.

Major Results

Alloplastic total prosthesis of the temporomandibular joint (TMJ) has good evidence of safety and efficacy, despite failures. Due to the failure of several of these systems, the use of alloplastic prostheses has drastically declined, despite their advantages over autogenous restorations. Thus, a study analyzed the criteria that must be met by a biomaterial to be considered suitable for implantation, as well as the common complications that may occur. Still, several

surface modification techniques are proposed as an alternative to the materials used in current TMJ prosthesis systems [11-13].

In this scenario, a study evaluated the main intra and postoperative complications associated with two different therapeutic approaches for the treatment of mandibular condyle fractures: conservative treatment (CTR) and surgical treatment (ORIF, Open Reduction, and Internal Fixation). A total of 2458 patients with 2810 fractures were collected for the study. Patients treated with CTR and ORIF were on average 29 years old, of those treated with CTR, 72.37% and 27.63% were male or female, respectively, and of those treated with ORIF, 70.36%, and 29.64 % were male or female, respectively. The main complications suffered by patients with CTR and ORIF were asymmetry (10.2%/6.4%), residual pain (6.5%/5.6%), temporomandibular joint and joint imbalance (15.9% /10.3%), and malocclusion (11.1%/4.0%), respectively. Significant differences were found between CTR and ORIF only in the number of cases of TMJ and joint imbalance and malocclusion. Facial nerve damage was found exclusively in patients with ORIF (8.6%), of which 8.3% were temporary and 0.3% were permanent [14].

Furthermore, a retrospective cross-sectional study in the US analyzed medical malpractice claims involving TMJ operations. A total of 1,455 closed claims occurred during the study period. There were 14 closed claims involving TMJ operations (0.96% of total claims). "Improper performance" was the most common alleged error for TMD claims. Two claims (1 TMJ arthroscopy and 1 TMJ replacement) were settled with payment, and the alleged error for these claims was a poor performance. No TMJ claim has received a court payment. Claims related to dentoalveolar and dental implants accounted for 68.73% (n = 1000) and 15.53% (n = 226) of all claims in the World Health Organization (WHONIC) registry, respectively [15].

In the context of dental implants, generalized periodontitis can impair the integrity of the dentition, which leads to functional disorders of the muscular apparatus, TMJ, and aesthetic defects. The effective method of restoring the integrity of the dentition is dental implantation. In this sense, the issue of dental implantation is of particular importance and requires further development including different age groups. One study sought to improve the results of dental implantation and avoid its complications based on identifying the causes of dental implantation complications and developing preventive measures in people of different age groups. A total of 65 patients aged 35-60 years with secondary adentia were under observation. The main study group included 45 patients aged between 35 and 60 years with secondary adentia caused by periodontal disease. The control group included 20 age-matched patients with secondary adentia due to caries complications. All patients in the main and control groups underwent a comprehensive examination of the condition of the peri-implant and periodontal area before implantation within the shortest time after surgery. The microbiological study was carried out on 65 patients to study the colonization dynamics of the oral microbiota. Complications after implantation were identified in 24 (53.33%) patients in the main group. The most frequent complications were: interruption of wound healing in 7 (15.56%) patients, pus in the postoperative wound in 8 (17.78%), expressed pain and altered sensitivity after implantation in 4 patients (8, 89%) patients, mandible perforation in 1 (2.22%) patient, a divergence of wound edges without implant exposure in 4 (8.89%) patients. A large number (53.33%) of postoperative complications in patients in the main group with secondary adentia were due to generalized periodontitis [16].

Besides, a study evaluated changes in pain and range of motion (ROM), as well as postoperative complications and comorbidities, in patients undergoing TMJ surgery. Data were obtained from 95 patients who underwent a total of 108 surgical procedures, with a mean followup of 4.48 ± 3.38 years. The most common primary indications for TJR were ankylosis (44%) and inflammatory disease (23%). Maximum interincisal opening improved by an average of 7.7 ± 10.27 mm and pain decreased by an average of 1.5 ± 3.29 points on the visual analog scale. Transient facial nerve paralysis (25%) was the most common postoperative complication; however, long-term complications were rare. The most frequent comorbidities were psychiatric disorders (56%) and gastrointestinal diseases (46%). Psychiatric patients had similar preoperative pain scores (6.0 ± 2.90) but significantly higher postoperative pain scores (4.7 ± 2.58) compared to non-psychiatric patients. Twenty-eight percent of patients had previous failures of TMJ implant materials, specifically Proplast-Teflon. These patients were significantly older (50.4 ± 8.26 years) and had shorter preoperative ROM (21.7 ± 8.85 mm) and shorter postoperative ROM (28.3 ± 9.59 mm). Therefore, patients showed a statistically significant increase in ROM and a reduction in pain [17].

One study analyzed TMD in the context of implant dentistry, noting that prolonged surgical procedures may be a risk for TMD. On the other hand, implant-supported prostheses contributed to the mitigation of some aspects of TMD. The included clinical studies showed that factors associated with implant placement, such as the long duration of surgical procedures, may represent risk factors for TMD. They also indicated the

long-term benefits of implant-supported restorations [18].

Finally, occlusal overload is considered one of the causes of late implant failure. A casecontrol study clarified the association between cross-sectional area (CSA) of the masseter muscle and late implant failure, being limited to implant-supported fixed prostheses. Cases with at least one late implant failure (n = 25 patients) were compared with controls (n = 82 patients) without implant failure. Patients were matched by age, sex, year of surgery, jaw, and type of tooth and bone graft. The incidence of late implant failure was significantly associated with the masseter muscle [19].

Conclusion

It was concluded that for the entire gear of the temporomandibular joint to work efficiently, occlusion, joint, musculature, ligaments, and psychological factors must be in complete harmony. Clinical studies have shown that factors associated with implant placement, such as the long duration of surgical procedures, may represent risk factors for temporomandibular disorders.

Acknowledgement

Not applicable.

Funding

Not applicable.

Ethical 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[@].

References

1. Ooi K, Aihara M, Matsumura H, Matsuda S, Watanabe Y, Yuasa H, Matsuka Y. Therapy outcome measures in temporomandibular disorder: a scoping review. BMJ Open. 2022 Aug 19;12(8):e061387. doi: 10.1136/bmjopen-2022-061387.
2. Tamimi D, Gunson M. Imaging of the Postoperative Jaws and Temporomandibular Joints. Neuroimaging Clin N Am. 2022 Feb;32(1):203-229. doi: 10.1016/j.nic.2021.08.010.
3. Briceno WX, Milkovich J, El-Rabbany M, Caminiti MF, Psutka DJ. Reconstruction of Large Defects Using Extended Temporomandibular Joint Patient-Matched Prostheses. J Oral Maxillofac Surg. 2022 Jun;80(6):1018-1032. doi: 10.1016/j.joms.2022.01.021.
4. Goker F, Russillo A, Baj A, Giannì AB, Beltramini G, Rossi DS, Buccellato FRP, Mortellaro C, Del Fabbro M. Custom made/patient specific alloplastic total temporomandibular joint replacement in immature patient: a case report and short review of literature. Eur Rev Med Pharmacol Sci. 2022 Dec;26(3 Suppl):26-34. doi: 10.26355/eurrev_202212_30792.
5. Zheng JS, Jiao ZX, Wei X, Chen MJ, Ahmed A, Yang C. Accuracy of digital templates for guidance of custom-made total temporomandibular joint replacement. Int J Oral Maxillofac Surg. 2022 Oct;51(10):1330-1336. doi: 10.1016/j.ijom.2022.01.019.
6. Ferneini EM. Temporomandibular Joint Disorders (TMD). J Oral Maxillofac Surg. 2021 Oct;79(10):2171-2172. doi: 10.1016/j.joms.2021.07.008.
7. Maini K, Dua A. Temporomandibular Syndrome. 2022 Apr 28. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan–. PMID: 31869076.
8. Wilkie G, Al-Ani Z. Temporomandibular joint anatomy, function and clinical relevance. Br Dent J. 2022 Oct;233(7):539-546. doi: 10.1038/s41415-022-5082-0.
9. Bach E, Breton P, Cousin AS, Louvrier A, Sigaux N. Prothèses d'articulation temporomandibulaire [Temporomandibular joint prostheses]. Rev Prat. 2020 Dec;70(10):11291133.
10. Namvar MA, Afkari BF, Moslemkhani C, Mansoori K, Dadashi M. The Relationship between Depression and Anxiety with Temporomandibular Disorder Symptoms in Dental Students. Maedica (Bucur). 2021 Dec;16(4):590-594. doi: 10.26574/maedica.2021.16.4.590.
11. Siegmund BJ, Winter K, Meyer-Marcotty P, Rustemeyer J. Reconstruction of the temporomandibular joint: a comparison between

prefabricated and customized alloplastic prosthetic total joint systems. Int J Oral Maxillofac Surg. 2019 Aug;48(8):1066-1071. doi: 10.1016/j.ijom.2019.02.002.
12. Amarista FJ, Mercuri LG, Perez D. Temporomandibular Joint Prosthesis Revision and/or Replacement Survey and Review of the Literature. J Oral Maxillofac Surg. 2020 Oct;78(10):1692-1703. doi: 10.1016/j.joms.2020.05.021.
13. De Meurechy N, Braem A, Mommaerts MY. Biomaterials in temporomandibular joint replacement: current status and future perspectives-a narrative review. Int J Oral Maxillofac Surg. 2018 Apr;47(4):518-533. doi: 10.1016/j.ijom.2017.10.001.
14. García-Guerrero I, Ramírez JM, Gómez de Diego R, Martínez-González JM, Poblador MS, Lancho JL. Complications in the treatment of mandibular condylar fractures: Surgical versus conservative treatment. Ann Anat. 2018 Mar;216:60-68. doi: 10.1016/j.aanat.2017.10.007.
15. Green MA, Resnick CM, Mercuri LG. Characteristics of Medical Malpractice Claims Involving Temporomandibular Joint Surgery in the United States. J Oral Maxillofac Surg. 2022 Jul;80(7):1153-1157. doi: 10.1016/j.joms.2022.04.003.
16. Borisenko A, Antonenko M, Zelinsky N, Stolyar V, Popov R. Early postoperative complications in dental implant patients. Georgian Med News. 2020 May;(302):23-28.
17. Sahdev R, Wu BW, Anderson N, Khawaja SN, Kim S, Keith DA. A Retrospective Study of Patient Outcomes After Temporomandibular Joint Replacement With Alloplastic Total Joint Prosthesis at Massachusetts General Hospital. J Oral Maxillofac Surg. 2019 Feb;77(2):280-288. doi: 10.1016/j.joms.2018.09.002.
18. Brazão-Silva MT, Guimarães DM, Andrade VC, Rodrigues DC, Matsubara VH. Do dental implant therapies arouse signs and symptoms of temporomandibular disorders? A scoping review. Cranio. 2021 Feb 22:1-10. doi: 10.1080/08869634.2021.1885885.
19. Takashima M, Arai Y, Matsuzaki N, Yamazaki Y, Nishiyama H, Nohno K. Masseter muscle cross-sectional area and late implant failure: A case-control study. Clin Implant Dent Relat Res. 2023 Apr;25(2):313-320. doi: 10.1111/cid.13189.