



Improving buccomaxillofacial surgical techniques and minimally invasive: a systematic review

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Abstract

Introduction: In minimally invasive there are several clinical studies with increasing expectations to establish treatment guidelines. Recently, advanced technology in the reconstruction of three-dimensional models based on computed tomography (CT), such as cone beam CT, has opened a new axis in the application of personalized and accurate diagnosis and has been increasingly used in the field of dentistry. **Objective:** This study aimed to analyze the evolution and consequent importance of improving surgical techniques and minimally invasive treatments in dentistry. It was hypothesized that there were statistically significant results on advances in minimizing trauma, providing patients with quality of life, and better aesthetics. **Methods:** The systematic review rules of the PRISMA Platform were followed. The search was conducted from June to July 2024 in the Web of Science, Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. 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 139 articles were found. 26 articles were fully evaluated and 15 were included and developed in the present systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 49 studies with a high risk of bias and 34 that did not meet GRADE and AMSTAR-2. Most studies presented homogeneity in their results, with $X^2=83.8\%>50\%$. The maximum preservation of the integrity of the soft tissues (papillae and free and inserted gingival band) adjacent to the prosthetic spaces should be sought; as preservation of the alveolar bone ridge

level. Based on the histological concept living tissues are formed by cells joined by thin elastic tissue and with nerve fibrils, capillaries, lymphatic and blood vessels. The disruption of these cells by surgical trauma provides the release of enzymes that delay healing. For this reason, surgical trauma should be minimized. There are many attempts to minimize the professional effort, reduce surgical time, and alleviate bleeding and inflammatory processes, edema, pain, and ecchymosis that can affect patients. Thus, the maximum preservation of the integrity of the soft tissues adjacent to the prosthetic spaces and the preservation of the level of the ridge of the alveolar bone to achieve a minimization of surgical trauma must be sought.

Keywords: Digital surgery. Minimally invasive surgery. Buccomaxillofacial surgery.

Introduction

In minimally invasive there are several clinical studies with increasing expectations to establish treatment guidelines. This selection of data was due to the significant increase in quantitative synthesis methods in the dental literature from the beginning of the 21st century [1-5]. Most of the selected studies were carried out in the USA, Netherlands, and UK. The remaining works were published in another 61 journals and originated in 32 other countries, including Brazil [6-8].

Dental transplantation appears as an alternative treatment for all social strata, being called biological prosthesis [9]. Thus, the transfer of a natural tooth from

its socket to another site is related to extensive caries, root resorption, periodontal disease, coronary radicular fracture, agenesis, and aplasia of teeth. The technique must be atraumatic for a better prognosis of the tooth to be transplanted since the periodontal ligament must not be manipulated, as it is necessary to repair periodontal tissues [9-11].

Also, oral cancer represents a mixture of genetic and epigenetic instability. Some of the minimally invasive procedures (chair-side diagnostics), such as vital staining and light-based systems, are widely used in clinical practice, as well as in the hospital environment, due to their simple and easy operability. Furthermore, these chair-side diagnostic procedures offer relatively good sensitivity and specificity, despite some of their limitations. These diagnostic tools can complement a good clinical history and thorough examination of patients for the early detection of pre-cancer and oral cancer [11-14].

A study aimed to present endodontic microsurgery using the guide model that can accurately target the apex position for the treatment of an anterior tooth with a calcified canal, untreatable with conventional root canal therapy and unable to track the position of the apex due to the absence of fistula. Thus, endodontic microsurgery is defined as the treatment performed on the root apex of an infected tooth, which was not resolved with conventional root canal therapy. Recently, advanced technology in the reconstruction of three-dimensional models based on computed tomography (CT), such as cone beam CT, has opened a new axis in the application of personalized and accurate diagnosis and has been increasingly used in the field of dentistry. However, direct intraoral location of the root apex based on three-dimensional information is extremely difficult and a significant amount of bone removal is unavoidable when the freehand surgical procedure has been employed. Also, gingival flaps and alveolar bone fenestration are sometimes necessary, which leads to a prolonged time of surgery, thus increasing the chance of trauma and the risk of infection [15].

Therefore, this study aimed to analyze the evolution and consequent importance of improving surgical techniques and minimally invasive treatments in dentistry. It was hypothesized that there were statistically significant results on advances in minimizing trauma, providing patients with quality of life, and better aesthetics.

Methods

Study Design

This study followed the international systematic review model, following the PRISMA (preferred reporting items for systematic reviews and meta-

analysis) rules. Available at: <http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1>. It was accessed on: 07/19/2024. The AMSTAR-2 (Assessing the methodological quality of systematic reviews) methodological quality standards were also followed. Available at: <https://amstar.ca/>. It was accessed on: 07/19/2024.

Data Sources and Search Strategy

The literature search process was carried out from June to July 2024 and developed based on Web of Science, Scopus, PubMed, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various periods to the present day. The descriptors (DeCS / MeSH Terms. Available on: <https://decs.bvsalud.org/>) were used: "Digital surgery. Minimally invasive surgery. Buccomaxillofacial surgery", and using the Boolean "and" between MeSH terms and "or" between historical findings.

Study Quality and Risk of Bias

The quality was classified as high, moderate, low, or very low regarding the risk of bias, clarity of comparisons, precision, and consistency of analyses. The most evident emphasis was on systematic review articles or meta-analysis of randomized clinical trials, followed by randomized clinical trials. Low quality of evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument by analyzing the Funnel Plot graph (Sample size versus Effect size), using Cohen's d test.

Results

Summary of Findings

A total of 139 articles were found that were submitted to eligibility analysis, and 15 final articles were selected from the total of 26 to compose the results of this systematic review. The studies listed were of medium to high quality (Figure 1), considering the level of scientific evidence of studies such as meta-analysis, consensus, randomized clinical, prospective, and observational. Biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies presented homogeneity in their results, with $X^2=83.8\%>50\%$. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 49 studies with a high risk of bias and 34 studies that did not meet GRADE and AMSTAR-2.

Figure 1. Flowchart showing the article selection process.

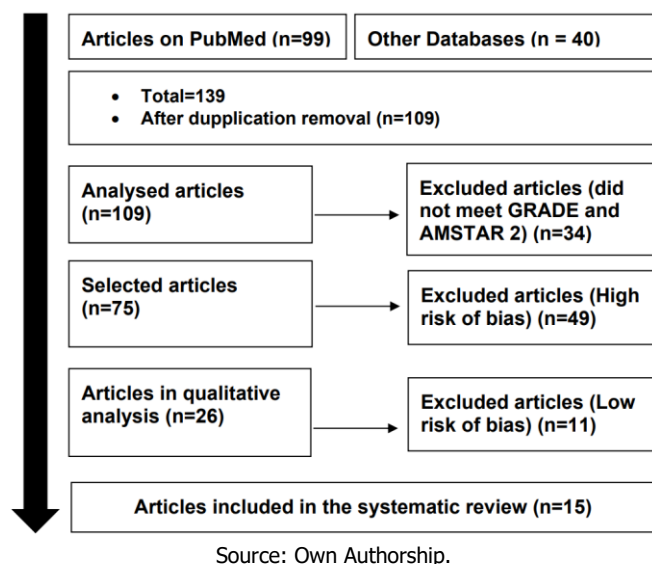
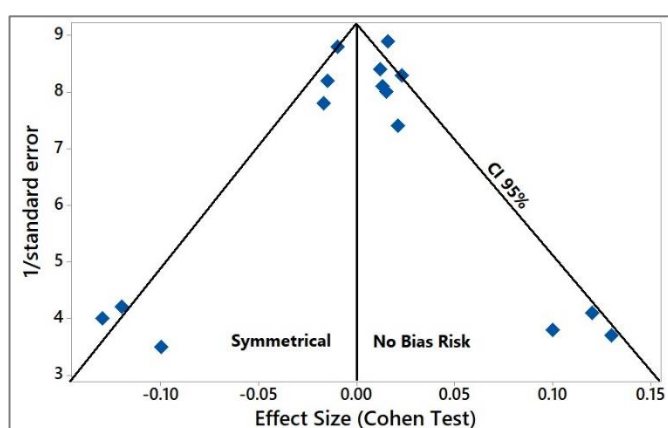


Figure 2 presents the results of the risk of bias of the studies using the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using Cohen's Test (d). Precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph had a symmetrical behavior, not suggesting a significant risk of bias, both among studies with small sample sizes (lower precision) at the base of the graph and in studies with large sample sizes at the top.

Figure 2. The symmetrical funnel plot does not suggest a risk of bias among the studies with small sample sizes, which are shown at the bottom of the graph. High confidence and high recommendation studies are shown above the graph (n=15 studies).



Major Outcomes and Significance

Thus, the application of minimal intervention concepts in dentistry and minimally invasive surgical techniques can offer a powerful arsenal to the general dentist to provide ethical and conservative treatment to elderly patients. When it is unavoidable, surgical intervention should be as minimally invasive as possible

in elderly patients to preserve the longevity of their natural dentition [1-3].

In this sense, performing indiscriminate extractions, without the objective of immediate or late rehabilitation of the new prosthetic space, promote serious biological and social consequences generated by tooth loss without adequate rehabilitation [6]. Thus, due to the enormous advance in minimally invasive techniques and the spread of modern implantology, and the level of safety of the treatment provided by it, in addition to the refined techniques for making conventional prostheses relatively safe if planned correctly, the patient can have adequate rehabilitation with various techniques [16-19].

If the maintenance of the original tissue contours is respected, the chances of achieving good esthetic levels and acceptable functional conditions increase considerably. These precautions are even more important and critical when the surgical procedure is performed in the anterior regions of the mouth [1-3]. The preservation of interproximal bone levels becomes essential to maintain the vertical level of the interdental papillae, avoiding dark areas and spaces between natural and artificial teeth, which can impair the aesthetic result that can produce real satisfaction for the patient [20].

Likewise, the preservation of bone and gingival integrity can drastically reduce the volumes of medication administered in the postoperative period and facilitate the making of appropriate profiles and contours of temporary gingival conditioning, even with conventional prosthesis procedures and techniques or immediate implants with immediate esthetics, are used for the rehabilitation of the case [1,21].

Thus, since the most primordial extraction techniques were created and developed, several attempts have been made to minimize the professional's effort, reduce surgical time and alleviate bleeding and inflammatory processes, edema, pain, and ecchymosis that can affect patients, in the trans and postoperative periods. Thus, the maximum preservation of the integrity of the soft tissues (papillae and free and inserted gingival band) adjacent to the prosthetic spaces should be sought; preservation of the alveolar bone ridge level [2,3,22].

Furthermore, the atraumatic restorative treatment (ART) was developed by Frencken in Africa to control the evolution of caries. The main functions of the ART are a preservation of the tooth structure with minimal operative intervention, reduction of endodontic treatment or tooth extraction, and reduction of patient discomfort due to no need for local anesthesia. About the partial removal of carious tissue, Imparato et al. (2010) cited the systematic review of the Cochrane

Library by Ricketts et al. (2006) [23].

Based on the histological concept in which living tissues are formed by cells joined by thin elastic tissue and with nerve fibrils, capillaries, lymphatic and blood vessels. The disruption of these cells by surgical trauma provides the release of enzymes that delay healing. For this reason, surgical trauma should be minimized. Trauma prevention is done through good surgical planning, working together, good lighting, control of force, knowledge of topographical anatomy, control of movements and gestures, search for a support point to reduce tremor, and decreased surgery time [1,24].

The basic rules that guide the doctrine of atraumatic surgical technique are the surgeon without tension, minimal and precise movements, dissecting only what is essential, reducing tissue exposure to a minimum, gentle handling, use of correct instruments and techniques, use of soaked swabs in warm saline solution [25]. As proof, atraumatic extraction techniques have several advantages over conventional techniques currently performed, especially with regard to maintaining the integrity of the alveolar bone and attached gingiva. They consist of controlled techniques, with a high level of predictability [26].

The technique, however, of controlled avulsion extraction can be considered the most predictable, ensuring maximum integrity of the alveolar bone wall, drastically reducing bleeding and especially the time of the procedure. Among the contraindications observed in this type of technique performed with the Xt Lifting®, we can mention the extraction of residual roots that are structurally very fragile, with very thin dentin walls, due to internal resorption or wear for the installation of metallic cores, among others. However, some of the innovations that are being developed exclusively for the Xt Lifting® system have emerged with great success, with the aim of guaranteeing the execution of atraumatic extractions in a wider range of clinical situations [26].

Conclusion

It was concluded the maximum preservation of the integrity of the soft tissues (papillae and free and inserted gingival band) adjacent to the prosthetic spaces should be sought; as preservation of the alveolar bone ridge level. Based on the histological concept living tissues are formed by cells joined by thin elastic tissue and with nerve fibrils, capillaries, lymphatic and blood vessels. The disruption of these cells by surgical trauma provides the release of enzymes that delay healing. For this reason, surgical trauma should be minimized. There are many attempts to minimize the professional effort, reduce surgical time, and alleviate bleeding and

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Conflict of Interest

The authors declare no conflict of interest.

Similarity Check

It was applied by Ithenticate®.

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It was performed.

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