



# Major considerations of minimally invasive surgery in bucomaxillofacial procedures: quality of life and aesthetics

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DOI: <https://doi.org/10.54448/mdnt22109>

Received: 12-01-2021; Revised: 01-20-2022; Accepted: 02-10-2022; Published: 02-22-2022; MedNEXT-id: e22109

## Abstract

**Introduction:** In minimally invasive or atraumatic surgery or dental procedures, there are several clinical studies with increasing expectations to establish treatment guidelines. It is estimated that in minimally invasive dental surgery in general, synthesis studies with meta-analysis and decision analysis represent almost 29% of all studies. **Objective:** Demonstrate, through a systematic review of the literature, the evolution and consequent importance of improving surgical techniques and/or minimally invasive treatments in dentistry. It was hypothesized that there were statistically significant results on advances in the attempt to minimize trauma, providing quality of life and better aesthetics to patients. **Methods:** The present study was followed by a systematic review model (PRISMA). The search strategy was performed in the PubMed, Cochrane Library, Web of Science and Scopus, and Google Scholar databases. The Cochrane Instrument was used to assess the risk of bias of the included studies. **Results:** The total of 92 articles involving minimally invasive surgery and dentistry were found. A total of 54 articles were fully evaluated and 23 were included in the present study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 3 studies with a high risk of bias (studies with small sample size) and 2 studies with uncertain risk (studies with results without statistical significance). 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 the inflammatory processes, edema, pain, and ecchymosis that can affect patients, in 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. 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. **Conclusion:** 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:** Minimally invasive surgery. Maxillofacial surgery. Atraumatic procedures. Dentistry.

## Introduction

In minimally invasive or atraumatic surgery or dental procedures, 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 [1,2]. 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 [3-5].

Thus, the studies were classified in the areas of periodontics, implantology, endodontics, orthodontics,

oral pathology, maxillofacial surgery, prosthesis, and others [4,5]. However, uncertainty is about the conclusions drawn from a set of studies on minimally traumatic surgery [3].

As a corollary, dental transplantation appears as an alternative treatment for all social strata, being called biological prosthesis [6]. 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 [6-8].

Furthermore, with the increasing modernization of implant dentistry, we have immediate implants as the procedure with the highest probability of success among the rehabilitation treatments of the oral cavity, using osseointegrated implants [6]. Immediate implants are those installed soon after the extraction of compromised roots or teeth, using the remaining alveolus for implant placement, minimizing trauma, and optimizing treatment [6,9,10].

Furthermore, 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].

Also, 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 [12].

Therefore, this study aimed to demonstrate, through a systematic review of the literature, the evolution and consequent importance of improving surgical techniques and/or minimally invasive treatments in dentistry. It was hypothesized that there were statistically significant results on advances in the attempt to minimize trauma, providing quality of life and better aesthetics to patients.

## Methods

### Study Design

The present study followed a systematic review model, following the rules of systematic review - PRISMA (Transparent reporting of systematic review and meta-analysis, access available in: <http://www.prisma-statement.org/>).

### Data Sources

The search strategy was performed in the PubMed, Cochrane Library, Web of Science and Scopus, and Google Scholar databases, using scientific articles from 2009 to 2021.

### Descriptors (MeSH Terms)

The main descriptors (MeSH Terms) used were "*Minimally invasive surgery. Maxillofacial surgery. Atraumatic procedures. Dentistry*". For greater specification, the description "bone regeneration" for refinement was added during the searches, following the rules of the word PICOS (Patient; Intervention; Control; Outcomes; Study Design).

### Selection of studies and risk of bias in each study

Two independent reviewers (1 and 2) performed research and study selection. Data extraction was performed by reviewer 1 and fully reviewed by reviewer 2. A third investigator decided some conflicting points and made the final decision to choose the articles. Only studies reported in Portuguese and English were evaluated. The Cochrane Instrument was used to assess the risk of bias of the included studies.

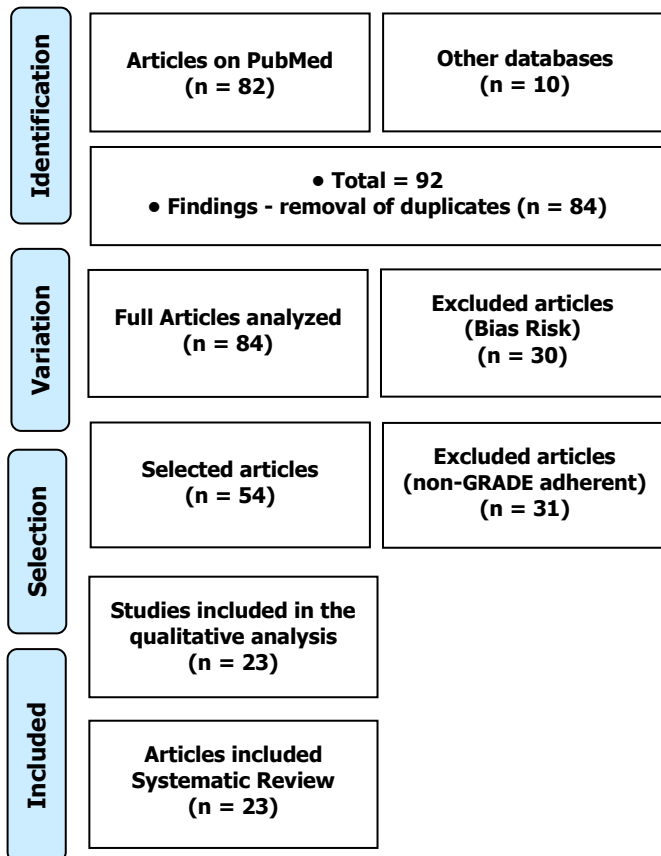
## Results

### Article Series and Eligibility

The total of 92 articles were found involving

minimally invasive surgery, maxillofacial surgery, atraumatic procedures and dentistry. Initially, the 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 bone regeneration using Biomaterials and/or fibrin-rich plasma. A total of 54 articles were fully evaluated and 23 were included in this study (Figure 1).

**Figure 1.** Flowchart showing the article selection process.



Considering the Cochrane tool for risk of bias, the overall assessment resulted in 3 studies with high risk of bias (studies with small sample size) and 2 studies with uncertain risk (studies with results without statistical significance). The domains that presented the highest risk of bias were related to the number of participants in each study addressed, and the uncertain risk was related to the bone maturation time for implantation. In addition, there was a lack of funding source in 3 studies and 1 study did not disclose information about the declaration of conflict of interest.

In addition, a study evaluated the stability of immediate implant placement for alveolar bone augmentation and preservation with bovine bone graft after atraumatic tooth extraction. Therefore, the insertion of immediate implants in extraction cavities with bovine bone with an increase in the buccal gap was able to preserve a greater amount of alveolar ridge

volume. There are no clinical studies evaluating the feasibility of a new technique for the surgical extrusion of non-restorable teeth with subgingival caries [6].

Another study analyzed that the combination of piezo-surgical surgery and conical expanders allows a safe displacement of the selected bone flap, as well as the immediate placement of the implant, avoiding the risk of slipping, overheating, or fracture, allowing operational comfort. Thus, non-traumatic bone expansion is a reliable, reproducible, conservative, and cost-effective procedure [13].

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 [14].

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 [3]. 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 [15,16].

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 [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 [17].

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 [3,6,18].

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 [3,19].

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, Imperato et al. (2010) cited the systematic review of the Cochrane Library by Ricketts et al. (2006) [20].

Also, Barreto (2007) cited works by Van Amerongen (2003) and Deery (2005) that compared the psychological behavior of children when using ART to conventional treatment. Heartbeats were monitored throughout the procedures and researchers concluded that manual instruments in atraumatic treatments caused less discomfort and anxiety than rotary instruments in the conventional technique [5].

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 [1,21].

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 [22].

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 [23].

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 [23].

## Conclusion

It is concluded that there have been several attempts to minimize the professional's 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.

## Acknowledgement

Nil.

## Funding

Not applicable.

## Data sharing statement

No additional data are available.

## Conflict of interest

The authors declare no conflict of interest.

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