

# Risks in surgery-first orthognathic approach: complications of segmental osteotomies of the jaws. A systematic review

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**Abstract. – OBJECTIVE:** To date, no systematic review has been undertaken to identify the complications of segmental osteotomies. The aim of the present systematic review was to analyze the type and incidence of complications of segmental osteotomies, as well as the time of subjective and/or clinical onset of the intra- and post-operative problems.

**MATERIALS AND METHODS:** A search was conducted in two electronic databases (MEDLINE – Pubmed database and Scopus) for articles published in English between 1 January 2000 and 30 August 2015; only human studies were selected. Case report studies were excluded. Two independent researchers selected the studies and extracted the data. Two studies were selected, four additional publications were recovered from the bibliography search of the selected articles, and one additional article was added through a manual search.

**RESULTS:** The results of this systematic review demonstrate a relatively low rate of complications in segmental osteotomies, suggesting this surgical approach is safe and reliable in routine orthognathic surgery.

**CONCLUSIONS:** Due to the small number of studies included in this systematic review, the rate of complication related to surgery first approach may be slightly higher than those associated with traditional orthognathic surgery, since the rate of complications of segmental osteotomies must be added to the complication rate of basal osteotomies. A surgery-first approach could be considered riskier than a traditional one, but further studies that include a greater number of subjects should be conducted to confirm these findings.

## Key Words

Orthognathic surgery, Complications, Segmental osteotomies, Facial esthetic, Systematic review.

## Introduction

Orthognathic surgical procedures are conventionally performed after a period of orthodontic alignment, leveling, and decompensation of dental arches<sup>1,2</sup>.

Brachvogel et al<sup>3</sup> proposed a different timing for the combined management of dentoskeletal imbalances: a surgery-first approach (SFOA) stated that the patient should immediately undergo corrective surgery without orthodontic pre-surgical preparation. In accordance with the four steps of Sendai's technique (i.e., diagnosis and establishment of the treatment plan, model analysis and prediction of post-surgical proper occlusion, orthognathic surgery, and the orthodontic phase), post-surgical orthodontics are administered with the additional aim to refine and stabilize surgical outcomes and obtain a balanced occlusal relationship<sup>4</sup>.

From a biological point of view, this concept is founded on the core principles of fracture healing: according to Frost's biological theories, the healing environment created by the surgical wound could cause teeth and the periodontium to be susceptible to active orthodontic forces<sup>5-6</sup>. This concept finds clinical evidence in many studies, in which different authors described the regional acceleratory phenomenon (RAP): the metabolic pattern induced by a surgical wound can enhance bone turnover, thus gaining faster results in dentoalveolar movements<sup>7</sup>.

In contrast to the conventional orthodontic-first (COF) approach<sup>8</sup>, this technique derives its benefits from avoiding orthodontic balance-ment before surgery.

In a prior study, pre-surgical orthodontic treatment was found to last a mean of 15.4 to 19.2

months, with a significant difference between the type of practice where it is performed<sup>9</sup> (i.e., faculty practice, university clinic, or non-university clinic); furthermore, it was found to determine a transient worsening in facial profile<sup>10</sup>.

Thus, overall treatment is likely to be shortened except for one-year postoperative management, which in certain cases could be shortened to four months<sup>11</sup>. However, this novel approach provides adequate achievements in the long-term stability of clinical results, and there have been very few patient complaints about poor aesthetic changes induced by pre-surgical orthodontic therapy<sup>12</sup>.

Given the absence of the presurgical orthodontic stage, this revolutionary approach requires extensive segmental osteotomies to achieve three-dimensional repositioning of the dentoalveolar complex. Thus the major role of segmental osteotomies is the establishment of treatment goals.

Some authors claimed that a possible drawback is that patients are exposed to major surgical complications, due to the complexity of the osteotomy procedures involved in this new approach<sup>13</sup>.

Conventional surgical correction of dental and skeletal disharmonies can be performed through basal or segmental osteotomies.

In rare instances, basal osteotomies present a various amount of sequelae, including those related to blood loss (pulp vitality, aseptic bone necrosis), uncontrolled hemorrhages, nerve injury, infection, skeletal relapse and post-operative malocclusion, temporomandibular joint disorders, unfavorable fracture in the sagittal split osteotomy site during bilateral sagittal split osteotomy, and depression. Despite the presence of published reports, these complications remain sporadic episodes<sup>14</sup>.

We found no literature about the major risks in the SFOA, but given that segmental osteotomies are more widely used than the traditional approach, we decided to analyze the literature for complications of segmental osteotomies.

The primary aim of this study is to conduct a literature review of studies on the type and incidence of complications of segmental osteotomies, as well as the time of subjective and/or clinical onset of the intra- and post-operative problems.

## **Materials and Methods**

### ***Search strategy***

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was consulted throughout this systematic review.

Two investigators (RP and ES) on 9 September 2015 performed a comprehensive and systematic electronic search in the MEDLINE - Pubmed database and Scopus for articles published in English between 1 January 2000 and 30 August 2015. Only human studies were selected.

For the MEDLINE – Pubmed database search, a combination of free text words was used:

(<[All fields] “surgery first”> AND <[All fields] “orthognathic surgery”> AND <[All fields] “complications”>);

For Scopus, another search strategy was used: TITLE-ABS-KEY (surgery first) AND TITLE-ABS-KEY (orthognathic surgery) AND TITLE-ABS-KEY (complication).

Also, the bibliographies of all articles selected for inclusion were scrutinized in order to include as many studies as possible, and a comprehensive and systematic manual search of journals the authors identified as potentially important for this review was conducted. The journals that were manually reviewed included: International Journal of Oral and Maxillofacial Surgery, Journal of Craniofacial Surgery, Journal of Cranio-Maxillofacial Surgery, the International Journal of Adult Orthodontics & Orthognathic Surgery.

### ***Selection criteria***

Studies were included if they dealt with a segmental osteotomy intervention that generated intra- or post-operative complications. Only studies published in English and conducted on human subjects were considered.

Exclusion criteria included:

- Case report studies;
- Studies that did not deal with surgical procedures;
- Studies that did not allow for the extraction of specific data on segmental osteotomy.
- Also, in the case of duplicate publications, the article with the most recent data was preferred.

### ***Selection of studies***

The screening was conducted independently by two reviewers (RP and ES). The initial electronic search resulted in 20 titles from the MEDLINE – Pubmed database and 22 titles from Scopus. After the independent elimination of duplicate papers, a total of 31 titles were considered for possible inclusion. Of these, 11 articles were removed on the basis of title and

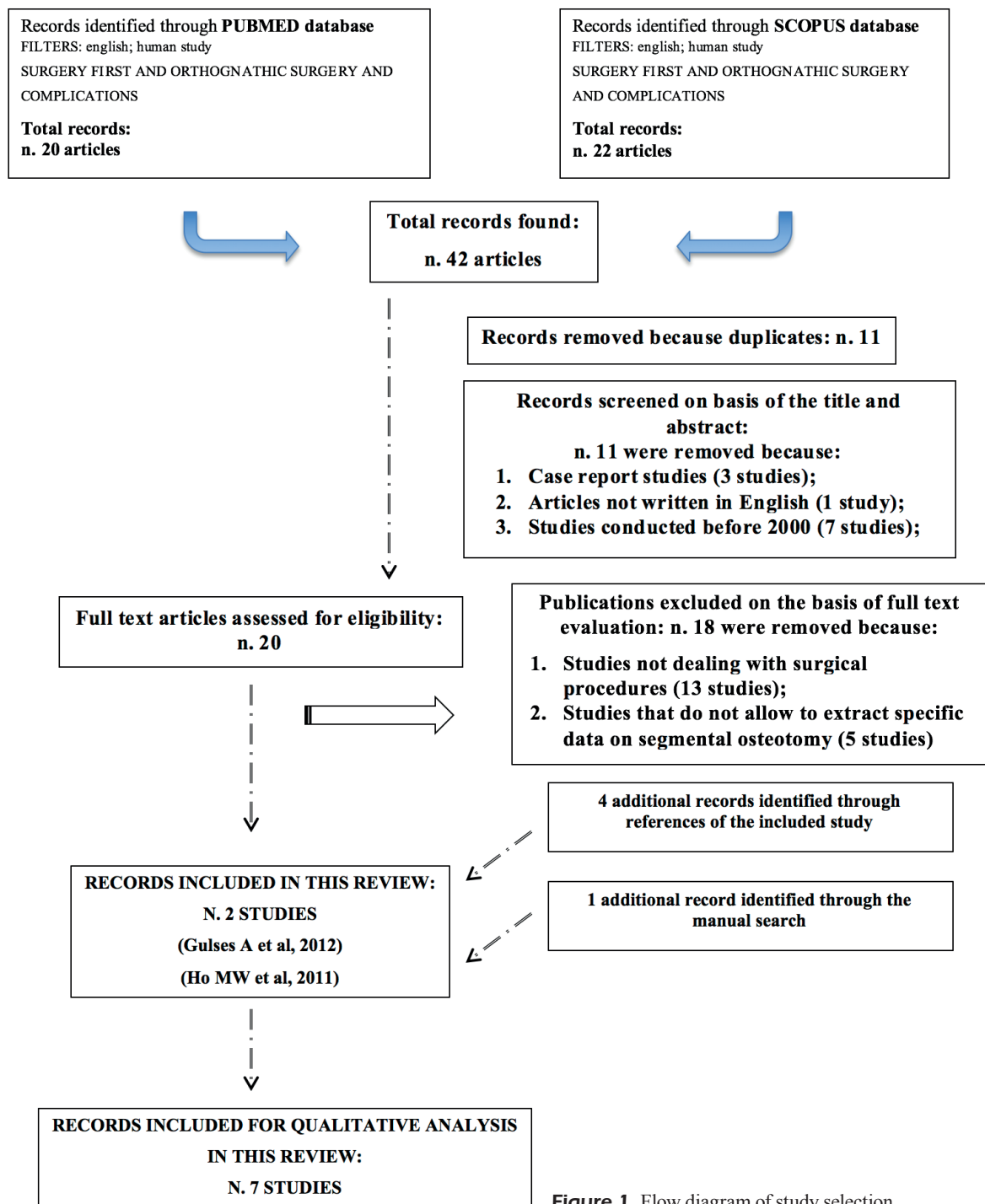


Figure 1. Flow diagram of study selection.

abstract, resulting in 20 full texts that were selected. From these studies, two were included in the review. Four additional publications were recovered from the bibliography search of the selected articles<sup>15-18</sup> and one additional article was added through the manual search<sup>19</sup> (Figure 1).

## Results

In total, seven studies met the inclusion criteria and were included for descriptive analysis in this systematic review (Table I).

Gulses et al<sup>20</sup> conducted a prospective study in which 24 sides (left and right) of 12 patients

**Table I.** Table summarizing the main results of the seven studies included in the systemic review.

Title, author, and publishing year	Main results
Evaluation of neurosensory alterations via clinical neurosensory tests following anterior maxillary osteotomy (Bell technique). Gulses et al 2012 <sup>20</sup> Surgical complications of segmental Le Fort I osteotomy. Ho et al 2011 <sup>21</sup>	The aim of the study was to evaluate the neurosensory alterations following AMO in cutaneous and vestibular and palatal mucosal regions. The authors concluded that neurosensory alterations can occur, but resolve spontaneously in 30 days. The authors presented the complication rates associated with segmental maxillary surgery. The overall complications rate was 27%; 9% of patients developed multiple complications. Nine patients (11%) had intraoperative complications whereas 18 patients (21%) developed postoperative ones.
Incidence of complications and problems related to orthognathic surgery. Kim et al 2007 <sup>15</sup> Intraoperative and perioperative complications in anterior maxillary osteotomy: a retrospective evaluation of 103 patients. Gunaseelan et al 2009 <sup>16</sup>	Evaluated the occurrence of intra- and postoperative complications of orthognathic surgery. The global prevalence was 2.7%. The authors concluded that orthognathic surgery appears to be a safe procedure. Retrospective evaluation of complications after AMO. The total rate of complications was 26.2%. The authors stated that AMO is a safe and reliable procedure.
Effects of the multiple-piece maxillary osteotomy on the periodontium. Morgan et al 2001 <sup>17</sup> Effect of segmental Le Fort I osteotomy on maxillary tooth type-related pulpal blood-flow characteristics. Emshoff et al 2000 <sup>18</sup>	Evaluated periodontal complications after MPMO. The results showed that periodontal damage was minimal, thus MPMO should not be avoided. Evaluated the short- and long-term effect of a segmental LeFort I (LF-I) osteotomy on tooth type related pulpal blood-flow (PBF) values. PBF values were significantly lower from preoperative to the 4 days postoperative assessment, and were significantly higher at the 56-day assessment than at the 4-day assessment. The authors concluded that the recovery of PBF may be related to the preservation and recovery of apical circulation.
Complications associated with segmentation of the maxilla: a retrospective radiographic follow up of 82 patients. Kahnberg et al 2005 <sup>19</sup>	Retrospective study examining the clinical and radiographic occurrence and frequency of injuries to teeth and their surrounding tissues adjacent to interdental osteotomies in conjunction with segmentation of the maxilla. The authors stated that only a small number of complications (e.g., osteolytic processes, marginal bone destruction, root resorption, or mechanical injuries to the teeth) were seen, and that segmental osteotomies can be considered a safe procedure.

(eight females and four males) with a mean age of 14.20±1.86 years (range 12-17 years) were treated for dental crowding, malocclusion, and/or maxillary hypoplasia with anterior segmental distraction osteogenesis performed following an anterior segmental osteotomy, using conventional osteotomy techniques. The aim of the study was to evaluate neurosensory alterations following anterior maxillary osteotomy (AMO) in cutaneous regions, including the lower eyelid, cheek, nose, upper lip, as well as vestibular and palatal mucosal areas, using simple clinical tests. Clinical neurosensory testing was performed on all patients preoperatively and at days 5, 7, 10, 30, and 60 postoperatively. No postsurgical neurosensory alterations were detected in the lower eyelid zone. In the cheek zone on postoperative day 5, the sensation was normal on only one side. The other 23 sides revealed subnormal and intermediate sensation values. On day 7 only two sides had subnormal sensitivity, and

on day 10 all tested sides revealed normal sensation. On the nose on postoperative day 5, eight sides were subnormal, 10 sides were intermediate, and four sides had reduced sensation values. On day 7, 16 sides were normal, six were subnormal, and two had intermediate sensitivity levels. On day 10, all tested sides revealed a normal sensation. In the upper lip zone on postoperative day 5, the sensation was reduced in 20 sides and intermediate in four sides. On postoperative day 7, 22 sides revealed intermediate and two sides revealed subnormal sensation values. On day 10, all tested sides showed a normal sensation. On the vestibular mucosa on postoperative day 5, the sensation was reduced in 20 sides and intermediate in four sides. On postoperative day 7, 22 sides revealed intermediate and two sides showed subnormal sensation values. On day 10, all tested sides revealed a normal sensation. On the contrary, on the palatal mucosa, no postsurgical neurosensory alterations were



detected in all 24 sides with all the clinical tests used. The authors concluded that, following AMO, neurosensory alterations could occur, but they resolve spontaneously within 30 days.

Ho et al<sup>21</sup> used retrospective review of medical records, radiographs, and study models to assess the complication rates associated with segmental maxillary surgery in 85 consecutive patients (mean age 23.3 years, range 14-51; male-female ratio 1:2) treated from 1995 to 2009. Patients were treated for anterior open bite (n = 30, 35%), transverse maxillary deficiency (n = 24, 28%), anterior open bite with transverse maxillary deficiency (n = 28, 33%), and anterior vertical maxillary excess (n = 3, 4%). Overall, complications occurred in 23 patients (27%); eight patients had multiple complications.

Nine patients (11%) had intraoperative complications: five (6%) had oronasal communication (four cases involved a transverse expansion of 1-5 mm); one patient experienced a labial gingival tear at the vertical osteotomy site; one patient sustained a root fracture of 1.5 and an exposure of the root of 2.5; one patient had unplanned segmentalization between 1.4 and 1.5, as well as 2.4 and 2.5 during mobilisation of the segments (cuts had originally been planned between 1.3 and 1.4 and between 2.3 and 2.4); and another patient (segmental maxillary osteotomy and advancement genioplasty) bled excessively intraoperatively (hemoglobin concentration decreased from 145 g/L to 85 g/L and was accompanied by deranged clotting times).

Eighteen patients (21%) developed postoperative complications related to segmental maxillary osteotomy. Four (5%) developed oronasal fistulas; one patient lost the 1.4 adjacent to the vertical segmental osteotomy cut because of a worsening tooth mobility that had been present before operation; three patients (4%) who developed late loss of teeth vitality required endodontic treatment; two patients had delayed union of the maxillary segments; one developed fibrous union of the anterior segment that required a cortico-cancellous iliac crest bone graft to achieve bony union; three patients developed periodontal complications: one had minor labial gingival recession at 2.3 (osteotomy between 2.2 and 2.3), one had dehiscence at the buccal gingiva of 1.6 (osteotomy between 1.5 and 1.6) that settled with conservative management, and the third patient developed gingival recession of 6 mm at 1.3, and 4 mm at 2.3 (osteotomy between 1.3 and 1.2 and between 2.2 and 2.3), which had been exacer-

bated by overzealous tooth brushing. Titanium mini plates were removed in eight patients (9%; two of whom also had loss of dental vitality) because of discomfort (n = 3) and recurrent infection (n = 5). The authors stated that the results showed a relatively low rate of complications, and that segmental maxillary surgery was safe as an adjunct treatment in carefully selected cases.

Kim et al<sup>15</sup> reported the results of a retrospective report evaluating the prevalence of intra- and postoperative complications of orthognathic surgery and their relevance in 301 patients who underwent surgery at Chosun University Dental Hospital, Korea, between 1998 and 2005. Among the 301 patients treated, nine (3%) underwent interventions of genioplasty and anterior segmental osteotomy. The complications that arose as a consequence of jaw surgery were divided into those that occurred during surgery category and those that occurred after surgery. During genioplasty and anterior segmental osteotomy, the authors reported one intraoperative complication (tooth damage) and nine postoperative complications (four cases of respiratory difficulty, three cases of sensory disturbance, as well as two cases of fever, headache, and infection). The global prevalence reported of intra- and postoperative complications after genioplasty and anterior segmental osteotomy was 2.7%. The authors concluded that, despite the great variety of severe complications reported, their frequency seemed to be extremely low and that orthognathic surgery appeared to be a safe procedure.

Gunaseelan et al<sup>16</sup> performed a retrospective evaluation of 103 patients undergoing AMO as a single procedure or in combination with other osteotomies; they investigated a five-year period (mean follow-up: three years) and analyzed various categories of complications (i.e., problems with airways, mechanical problems, hemorrhage, vascular complications, and soft-tissue injuries). The total number of complications encountered was 27 (26.2%): one patient had an intraoperative perforation of the endotracheal tube, caused by the surgical drill; one patient experienced excessive bleeding during the procedure without any identifiable cause; dental hypersensitivity after osteotomy was reported in nine cases; one patient had to be operated upon twice because of an unsatisfactory postsurgical aesthetic outcome; an increased interdental space at the osteotomy site was recorded in one patient; palatal mucosal tear was the most frequently encountered complication (11 patients); one patient had a buttonhole tear in the

midpalatal region; one patient had a palatal hematoma; a severe complication (i.e., partial mucosal necrosis at the osteotomy site) was recorded in one patient in whom a circum-vestibular incision with a vertical release incision was used. In this patient, the entire labial alveolar mucosa, including the free and attached gingiva, showed signs of necrosis, starting on the first postoperative day. The authors stated that although its indications are limited, AMO is a safe and reliable procedure in routine orthognathic surgery.

Morgan et al<sup>17</sup> conducted a study that critically evaluated the periodontium following the use of the multiple-piece maxillary osteotomy (MPMO) to ascertain if minor morbidities were inherent to the procedure, and to quantify them. The authors reviewed the records of 24 MPMO patients, ranging from 3 to 24 months after surgery. Periodontal probing depths at the segmental osteotomy sites were compared with the adjacent interproximal spaces of each patient: the mean difference between these two sites was 0.01 mm, with a standard deviation of 0.25 mm. The authors found no statistically significant differences. Independent examiners also found no difference in gingival architecture or alveolar bone levels when comparing vertical osteotomy sites to neighboring interproximal sites. This study showed that damage to the periodontium at vertical osteotomy sites was minimal, and thus there was no reason to avoid the use of MPMO.

Emshoff et al<sup>18</sup> analyzed data from 12 patients to evaluate the short- and long-term effect of a segmental LeFort I (LF-I) osteotomy on tooth type related pulpal blood-flow (PBF) values. PBF values were analyzed with Laser Doppler flowmetry. All patients underwent segmental LF-I osteotomy (two in two segments, seven in three segments, and three in four segments). The sample included eight women and four men, with a mean age of 22 years (range: 15 to 35 years). The authors reported that segmental LF-I osteotomy had a significant effect by decreasing session-related PBF measurements. PBF values for all tooth types were assessed before surgery (mean value: 10.3 Perfusion units -PU-) and were significantly higher than those assessed four days after surgery (8.1 PU,  $p < 0.01$ ). Measurements at the canine made before surgery (mean value: 10.5 PU) were found to be significantly higher than those made four days after surgery (7.8 PU,  $p < 0.01$ ). Analyzing the data according to the performance of interdental osteotomies, except for the central incisors, a significant decrease

in PBF values from preoperative measurement to 4 days postoperative assessment was found for teeth adjacent to the vertical osteotomy cuts, namely the lateral incisors ( $p < 0.05$ ), canines ( $p < 0.05$ ), and first premolars ( $p < 0.05$ ), whereas no significant differences between the preoperative and postoperative values were found for teeth not adjacent to the vertical osteotomy cuts ( $p > 0.05$ ). PBF values at the lateral incisor (mean value: 11.6 PU) and those for all tooth types (mean value: 9.9 PU) adjacent to the vertical osteotomy cuts were found to be significantly higher at the 56-day assessment than at the four-day assessment (7.1 PU and 7.5 PU, respectively;  $p < 0.05$ ). The authors speculated that the recovery of PBF after a distinct period might be related to the preservation and recovery of apical circulation, which results from the maintenance of anastomoses between the apical dental artery and the apical and intra-alveolar arteries originating from the mucoperiosteum.

Kahnberg et al<sup>19</sup> presented the results of a retrospective study that examined the clinical and radiographic prevalence and frequency of injuries to teeth and their surrounding tissues adjacent to interdental osteotomies in conjunction with segmentation of the maxilla. Vertical interdental osteotomies had been performed in combination with LF-I osteotomy to correct various dento-facial deformities. Eighty-two consecutive patients who underwent dento-facial correction by segmented maxillary osteotomy alone or in combination with simultaneous mandibular surgery between 1992 and 1998 were included in the study. Patients were followed for up to 30 months postoperatively: a total of 158 interdental osteotomies involving 316 teeth were performed. Among the 82 patients treated, 36 (43.9%) underwent segmented LF-I osteotomy and eight (9.8%) underwent anterior mandibular osteotomy. Two and six months after surgery, 11 and 17 teeth were surrounded by a widened periodontal ligament space (WPLS), respectively; at 18 months one tooth was diagnosed as having a WPLS (the same condition was also observed at 30 months); 18 months after surgery osteolytic lesions surrounded two teeth (one was diagnosed as a WPLS at two months and one at six months). At 30 months osteolytic lesions surrounded three teeth, and one of these was endodontically treated between the 18 month and the 30 month examination. Root resorption was observed in eight teeth. The horizontal bone loss was only seen in one patient, involving two teeth. This was first observed after six months

and increased to a total loss of approximately 3 mm of bone at 30 months.

One angular bone defect was seen until 18 months after the surgery and another one for as long as 30 months. Six months after surgery, seven teeth were identified with angular defects, six of which had not been previously observed. At two months, two teeth had injuries caused by the surgical segmentation of the maxilla. A third tooth was classified as iatrogenically injured at six months, likely attributable to burr trauma during segmentation. The authors stated that only a small number of complications such as osteolytic processes, marginal bone destruction, root resorption, or mechanical injuries to the teeth were seen, and that segmental osteotomies could be considered a safe procedure.

## Discussion

Not much literature can be found on SFOA complications, but since all the techniques used in this approach are already well known and codified, it is possible to indirectly refer to those technique complications as surgery-first complications.

During SFOA, the surgeon has to deal with orthodontically untreated dental arches, for this reason resorting to segmental osteotomies occurs more often than in traditional orthognathic surgery in order to obtain a surgical decompensation of the malocclusion and an immediate improvement in aesthetic and function. Furthermore, a more stable and treatable occlusion is provided after the operation, leading to a faster orthodontic therapy.

The spectrum of complications associated with segmental osteotomies is very similar to that reported in basal osteotomies and it varies greatly from minor problems with dental hypersensitivity to fear of loss of an osteotomy segment because of avascular necrosis.

As stated by Baik et al<sup>22</sup>, multisegmental osteotomies may involve many risks, such as tooth and periodontal injury; in conjunction with interdental osteotomy they can induce increased bleeding or problems with wound healing. Reduced blood supply and avascular necrosis of various segments were also reported. The decreased vascularity damages can range from loss of tooth vitality to periodontal defects, tooth loss, marginal bone destruction, and loss of major dentoalveolar segments. Lanigan et al<sup>23</sup> stated that necrosis was most likely to occur with LeFort I osteotomies in conjunction with superior repositioning and transverse expansion, rather

than with antero-posterior changes. The transverse expansion is known to have a more significant effect on blood supply than the sole segmentalization. Some authors noted that preservation of the blood supply in the descending palatine arteries is critical for preventing aseptic necrosis, but others commented that it is only a contributing factor rather than the main cause. The threshold for a decrease in vascular supply that results in aseptic necrosis is unknown. However, as surgical skills and knowledge have developed, these complications have become less common. Many authors showed that multisegmental surgery can be safe and has only limited and minor complications when performed according to basic principles and when following a meticulous treatment plan.

Kretschmer et al<sup>24</sup> reported that segmentation of the maxilla did not result in major skeletal or dental instability. Arpornmaeklong et al<sup>25</sup> reported that stable occlusal interdigitation is necessary for postoperative healing and stability

In his work on 85 patients, Chen and Yeow<sup>26</sup> reported no main complications during or after subapical osteotomies, and that only 3.5% of patients reported minor complication such as localized gingival retraction and nerve disturbances. On the other hand, authors like Merrill and Pedersen<sup>27</sup>, Burk et al<sup>28</sup>, and Bell et al<sup>29</sup> reported cases of tooth or bone segment loss.

According to Chen and Yeow<sup>26</sup>, complications can be avoided by respecting the vascular physiology of the jaw bone whose blood irrigation is provided by facial branches arteries and by muscle attachments and oral mucosa. Since the direct arterial irrigation is compromised in segmental osteotomies, respect for the attached tissues should be of mandatory importance; for this reason it is suggested that the following aspects are of critical importance in multisegmental osteotomies (especially in surgery-first where a splint is always placed): the amount of stripping of the periosteum and muscle attachments, eventual compression of the palatal mucosa with a splint, and strangulation of the buccal gingiva with intermaxillary fixation wires.

Ho et al<sup>21</sup> published a retrospective study with a patient sample as big as the one studied by Chen and Yeow<sup>27</sup>, stating that the overall complication rate was 27%; however, he also included internal fixation removal, which was not taken into account by Chen and Yeow<sup>27</sup>. In his series, three patients (4%) had devitalisation of teeth, three (4%) developed minor periodontal defects, and one had tooth loss. Eight patients (9%) had plates

removed for discomfort or recurrent infections, and two patients developed a persistent postoperative palatal fistula.

The importance of blood flow was also underlined by Emshoff et al<sup>18</sup>, who reported that a transient decrease of pulpar blood flow is present after multisegmental osteotomy of the maxilla, suggesting that degenerative changes can be related to this decrease.

Other similar problems were reported by Gunaselaan et al<sup>16</sup>: in a series of 103 procedures, complications were attributable to different causes. Soft tissue injuries (43.3%) and dental complications, mostly in the form of dental hypersensitivity (36.6%), were the most commonly observed sequelae. All other complications, like hemorrhage and compromised airway, accounted for the remaining 20%.

Neurosensory problems related to multisegmental osteotomy of the maxilla were further studied by Gulses et al<sup>20</sup>, who evaluated postoperative sensitivity in the cutaneous regions, including the lower eyelid, cheek, nose, upper lip, as well as the vestibular and palatal mucosal areas. Gulses et al<sup>20</sup> stated that a neurosensory disturbance can be present in the vestibular mucosa, upper lip, nose, and cheek, but that a spontaneous recovery occurs in 30 days.

### Conclusions

From the literature review, nothing specific can be found on the matter of complications from SFOA, but since the surgical techniques do not differ from the traditional approach, all complications connected with it should be considered. As the only difference with the traditional approach is the frequent recurrence to segmental osteotomies, all the complications related to them should be considered. For this reason, due to the lack of data, we can speculate the rate of complication related to SFOA could be slightly higher than that of the traditional orthognathic surgery, since to the complication rate of basal osteotomies the rate of complications of segmental osteotomies must be added. As stated in literature, the rate of major complications for segmental osteotomies is not high and the rate of minor complications can be reduced by sparing the periosteal, mucosal, and muscular insertions in order to save the blood supply to bones and teeth<sup>30-32</sup>.

For all of the above-mentioned reasons, surgery-first can be a little riskier than the traditional approach; thus, it should be performed by skilled surgeons.

Considering the small number of papers published in the literature, clinicians should be more careful in designing future studies, which could better evaluate the complication rate of the SFOA.

### Conflict of Interest

The Authors declare that they have no conflict of interests.

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