

## Systematic Review Orthognathic Surgery

# Systematic review of changes in maxillary incisor exposure and upper lip position with Le Fort I type osteotomies with or without cinch sutures and/or VY closures

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**Abstract.** The aim was to systematically review the maxillary incisor exposure and upper lip position changes with Le Fort I type osteotomies for advancement  $\pm$  impaction with rigid internal fixation, taking into account the use of cinch sutures and VY closures. Electronic databases (Cochrane Library, Medline, Embase, and Web of Science) were searched using medical subject headings (MeSH), key words, truncations, and Boolean operators. Hand searching was also undertaken. Of 979 articles identified, 15 were included (11 retrospective, two prospective, and two unspecified). Relevant study details and outcomes were recorded on a spreadsheet, along with an assessment of their quality. In total, these studies assessed 419 patients (266 female, 118 male) with a mean age of 26.4 years (range 14–57 years). Soft tissue changes were assessed on lateral cephalometric radiographs. The mean maxillary hard tissue advancement and impaction ranged between 0.94 and 8.77 mm and  $-0.56$  and 4.2 mm, respectively. The ranges of ratios demonstrated that from pronasale (0.24–0.35) to labrale superius (0.36–1.43), the soft tissues followed the underlying horizontal hard tissue movement increasingly more closely. Alar base cinch sutures and VY closures tended to increase these ratios. The soft tissue response was more variable vertically. None of the studies reported on maxillary incisor exposure change. More good quality prospective studies are needed.

**Key words:** maxillary incisor exposure; Le Fort I osteotomy; orthognathic surgery; cinch suture; VY closure.

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Systematic reviews allow condensation of available research on a specific topic and analysis of both the quality of research being undertaken and the outcomes of the studies themselves. The latter can be merged in a meta-analysis,

provided the studies are homogeneous with regards to sample characteristics, interventions, follow-up protocols, and outcome measures. In addition, it may highlight what further research would be helpful. Previous systematic reviews in

the field of orthognathic surgery have focused on the accuracy of computer programs in predicting hard<sup>1</sup> and soft tissue<sup>2</sup> responses to orthognathic surgery, the soft tissue changes following anterior segmental surgeries,<sup>3</sup> bilateral

sagittal split osteotomy (BSSO) for mandibular setback,<sup>4</sup> and the effects on speech.<sup>5</sup> However, no systematic review has been undertaken to assess the maxillary incisor exposure change and soft tissue response to Le Fort I type maxillary osteotomies for advancement  $\pm$  impaction taking into account the effect of alar base cinch sutures and VY closures.

Contemporary orthognathic surgical planning revolves around the position of the maxillary incisors in relation to the soft tissue envelope of the face and lips to achieve ideal facial aesthetic and dental occlusal outcomes.<sup>6</sup> The dynamic relationship of the maxillary incisor exposure on smiling is also an important aesthetic parameter.<sup>7</sup> Therefore, predicting the effect of different surgical movements on soft tissues and the effect of these on the incisor exposure is the key to planning the case. When using computer software or undertaking hand prediction tracings, the soft tissue changes are predicted by using the hard to soft tissue ratios calculated by previous studies. In a systematic review, Kaipatur and Flores-Mir<sup>2</sup> found that although the individual errors were minimal (less than 2 mm) between the prediction and the actual measurement, the amalgamation of these minimal errors could have clinical implications.

Therefore, it would be interesting to identify which variables have been accounted for in the research that has developed these ratios, and potentially which variables might be limiting the accuracy of the predictions and could be borne in mind in future research to improve the planning and prediction of surgical outcomes, e.g. if alar base cinch sutures and VY closures have an effect on the soft tissue response.

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used in this review.<sup>8</sup> The aim was to systematically review the literature on the change in maxillary incisor exposure (repose and smiling) and soft tissues (especially the upper lip) after a Le Fort I type maxillary osteotomy for advancement  $\pm$  impaction with rigid internal fixation, with or without a mandibular procedure.

The specific questions to be answered were:

- (1) What is the relationship between the maxillary incisor exposure change (in repose and on smiling) and the skeletal movement in maxillary Le Fort I type osteotomies for advancement  $\pm$  impaction?
- (2) What is the relationship between the soft tissue changes (particularly the upper lip) and skeletal movement in maxillary Le Fort I type osteotomies for advancement  $\pm$  impaction?
- (3) Is there an effect on the above results if additional surgical techniques such as alar base cinch suture, V-Y closure, or anterior nasal spine recontouring are undertaken?

## Materials and method

The following electronic databases were searched in September 2011: Cochrane Library (Issue 9 of 12, September 2011), EMBASE (1980 to week 35 of 2011), Medline (1948 to week 4 of 2011), and Web of Science (Science Citation Index Expanded 1899 to present and Conference Proceedings Citation Index 1990 to present).

The key words used were: upper, maxilla\* surgery, maxilla\* advancement, maxilla\* impaction, orthognathic surgery, Le Fort I, osteotomy, teeth OR tooth OR incisor\*, lip OR lips, and the combination of the above terms using "AND". Medical subject heading (MeSH) terms such as osteotomy, lip, and incisor were also used and all their trees exploded. The search was devised for Medline and EMBASE and revised appropriately to suit Science Direct and PubMed, where a combination of free text terms with Boolean operators and truncations were employed. An example of the search and combinations carried out in Cochrane is attached as [Appendix 1](#). No limitations were used regarding language or publication type.

In addition, hand searching included retrieving relevant articles mentioned in the reference lists of identified articles and reading special editions dedicated to orthognathic surgery in well known journals in maxillofacial surgery and orthodontics. Duplicates were discarded.

The inclusion criteria for the selection of studies were the following: (1) Retrospective or prospective clinical studies with human subjects including randomized controlled trials, case controlled studies, and case series. (2) Patients who had undergone orthognathic surgery to the maxilla (Le Fort I impaction and/or advancement), excluding those where it was stated that circumferential wires and/or intermaxillary fixation (IMF) had been used postoperatively. Ideally, the use of rigid internal fixation should have been stated. (3) If adjunctive techniques such as alar base cinch suture (AB), V-Y closure of incision (VY), or anterior nasal spine

(ANS) remodelling were used, the number of patients who received this should ideally be specified and their results analyzed separately. (4) Participant characteristics should be specified: age, gender breakdown. (5) Length of follow-up should be at least 3 months to allow for soft tissue swelling to settle. (6) Outcomes should be stated in terms of the changes in amount of maxillary incisor exposure after the surgery and/or soft and hard tissue changes related to the change in upper lip position. (7) Outcomes could be measured on lateral cephalometric radiographs, clinically (if direct measurements were taken with callipers), or from other sources such as photographs or laser scanning images.

Case reports, technical notes, opinions, editorials, oral presentations, review articles, and studies involving animal models or patients with clefts, trauma, or syndromes were excluded. If the same data from a study were reported in two different articles, only one of the articles was included. The reason for including only rigid maxillary fixation was to reduce the variables and aim the review at the current practice of fixation in orthognathic surgery. However a comparison to some papers using other fixation methods will be discussed.

An initial screening was undertaken based on titles and abstracts, following which full text articles were retrieved and reviewed for those that appeared to fulfil the inclusion criteria and for those for which more details were necessary prior to a decision. The article selection, data extraction, and quality appraisal were performed by LKL with discussions with FBN to solve doubts.

The data retrieved from the selected studies included: sample size and characteristics (age, gender breakdown, ethnicity, and malocclusion), study design, surgical treatment details (including the use of adjunctive procedures such as alar base cinch sutures, VY closures, or ANS recontouring), and outcome measures (type of imaging, timing, and actual measurements). The outcome measures had to include a measurement related to maxillary incisor exposure change and/or changes in the soft tissues of the upper lip. Data were collated on an Excel spreadsheet. The risk of bias of the studies included was assessed using a quality assessment checklist ([Fig. 1](#)), which has been described in a previous systematic review.<sup>1</sup>

## Results

In total, 979 articles were identified, of which 47 full length articles were

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