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Long-term stability of limiting nasal alar base width changes with a cinch suture following Le Fort I osteotomy with submental intubation

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Abstract. The aim of this study was to assess the effectiveness of the nasal alar base cinch suture following Le Fort I osteotomy at long-term follow-up. One hundred and forty participants (89 female, 51 male) aged between 16 and 51 years underwent Le Fort I osteotomy with submental intubation. Anthropometric measurements of the nose were taken intraoperatively, immediately postoperative, and for up to 3 years postoperative: the maximum lateral convexity of the alae (Al–Al) and the lateral extremity of the alar base curvature at the alar groove (Ac–Ac). The use of a cinch suture was recorded. The results were analysed using a linear mixed-effects model analysis. One hundred and six participants had cinch sutures and 34 had no cinch sutures. Following Le Fort I osteotomy, there were significant increases in Ac–Ac (by 4.29 mm) and Al–Al (by 3.70 mm) (both $P < 0.0001$). Cinch sutures significantly reduced the widths back to preoperative values ($P < 0.0001$). Alar width remained stable over 3 years, with an increase of 0.36 mm for Al–Al ($P > 0.05$) and 1.03 mm for Ac–Ac ($P < 0.05$) compared to the postoperative measurement. In conclusion, a cinch suture was helpful in reducing the unwanted alar base width changes, which were found to be relatively stable at 3 years.

Key words: Le Fort I osteotomy; cinch suture; nasal width; alar base width; stability.

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Facial aesthetics can be one of the most important factors for patients seeking orthognathic surgery; therefore both the oral and maxillofacial surgeon and the orthodontist need to plan for the final soft tissue morphology of the patient in relation to the planned skeletal movements. Whilst orthognathic treatment can achieve aesthetically pleasing results, the main area of concern can be the changes in the soft tissues with maxillary moves, in particular the appearance of the nose[1].

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Soft tissue changes with Le Fort I osteotomy

Changes in the position of the jaws can lead to changes in the soft tissues of the lips, cheeks, and nose[1]. The changes in the lip include thinning, reduced vermillion show, and lack of adequate lip support[2]. In relation to the nose, upturning of the tip, an increase in alar base width, and an increase in nasolabial angle frequently occurs[3]. This may not be apparent immediately, as it is well documented that soft tissue swelling can take up to a year to resolve postoperatively[4]. Greater than 10% change over 5 years has been shown to continue to occur in certain regions, such as the subnasale and lips[4].

Many of the nasal changes that occur with surgery are unpredictable and are much more complex than previously thought. They depend both on the structure of the nose (nasal cartilage connective tissue, anterior nasal spine, and the other nasal cartilages) and the degree of maxillary move. Patient factors such as soft tissue morphology and thickness, postoperative healing, age, and ethnicity can also influence these changes. These changes may be either unfavourable or beneficial, depending on the preoperative nasal morphology.

The only predictable change is the nasal width. This has been known to increase with Le Fort I osteotomies. Anecdotally, the larger the maxillary move the larger the change. Adjunctive procedures to limit these changes at surgery can be undertaken, such as a cinch suture and piriform aperture sculpting. Another option would be to accept the changes and carry out procedures at a later date, the disadvantage being the requirement of an additional surgical procedure, e.g. alar wedge resection rhinoplasty. The cinch suture combined with a VY closure (ACVY) is an efficient and less invasive way to control nasolabial changes, and therefore knowledge of the long-term results of its use would be advantageous to clinicians.

Cinch suture effectiveness in the long term

The cinch suture was first described by Millard, who used it to correct nasal deformities in patients with cleft lip and palate via an extraoral approach[5]. An intraoral approach was then described by Collins and Epker, which is now utilized as the classic cinch suture[6]. There has been some debate over the effectiveness of the cinch suture in controlling the alar bases following Le Fort I osteotomy, and those with normal or slightly increased alar base widths would find the increase undesirable. Some studies have found the alar base cinch suture to limit unwanted nasal width increases[1,7–9]; however the opposing view is that this has no effect on limiting widening of the alar base and that the nasal width continues to increase over time[3,10,11]. Another concern is that the cinch suture can produce an unnatural appearance with an increase in the nasolabial angle[7].

Different methods to measure nasal changes have been described over the years. These include anthropometry, two-dimensional (2D) imaging such as photographs and cephalometric radiographs, and three-dimensional (3D) technologies such as laser scanning, cone beam computed tomography (CBCT), and stereophotogrammetry. The cost implications with the newer 3D methods have limited this research. Anthropometry can be seen as an accurate way of measuring alar base width changes compared to 2D imaging and avoids the costs of 3D imaging.

Guymon et al., in a retrospective study, compared the use of a cinch suture ($n = 13$) versus no cinch suture ($n = 15$) in 28 patients undergoing a Le Fort I procedure[1]. In their study, the cinch suture group demonstrated significantly less widening after 12 months (2.89%) when compared to the group without a cinch suture (10.75%). Although stable landmarks were chosen to allow comparison of alar base width changes preoperatively and postoperatively from the photographs, inaccuracy may still exist due to errors with the reproducibility of the photographs.

Edler et al. also measured the effects of the cinch suture on nasolabial tissues after 12 months utilizing standardized digital photographs[9]. They found similar results to Guymon et al.[1], with the alar bases increasing by a minimal amount of just 0.8 mm $\pm$ 3 mm with a cinch suture, and concluded that it was effective at controlling the alar width. However, the difference with this study compared to the former was the utilization of submental intubation. The advantages of submental intubation are that it avoids distortion of the nose by the tube, allows direct observation of nasal change during the surgery, and permits accurate placement and tightening of the cinch suture to the optimal width.

Westermark et al. also found the cinch suture to be effective at controlling the alar width, with the control group experiencing a greater increase in alar width[7]. In contrast, Betts et al. found that the cinch suture was not effective at controlling the alar width compared to the control group[3], and this was also found in other studies[10,12,13].

A limited number of recent studies have utilized 3D imaging to measure the alar base width to try and counteract the flaws of previous 2D imaging studies. A prospective randomized controlled trial was performed by Howley et al., involving 28 patients randomized by computer-generated random number sequence into a cinch suture group and a control group with no cinch suture[10]. The measurements were taken using a 3D optical surface laser scanner. The results showed that the alar base width increased by a median of 2 mm in all patients between 1 and 6 months postoperatively. The cinch suture did produce less widening of the alar base after 6 months, but this difference (0.5 mm) was stated as not clinically significant. The sample size of this study was again particularly small and it was stated by the authors that it may not be large enough to reach firm conclusions. Three surgeons operated, and although this allows applicability of the results, it can also result in variability in technique which can affect the results. Furthermore, this study only reviewed the effects after 6 months, which would not have allowed for resolution of postoperative oedema or assessment of long-term changes.

Studies utilizing CBCT images to measure nasal changes have also been performed[11,13,14]. These studies all found that the cinch suture had no effect postoperatively at controlling alar base widening. However, two of the studies only measured changes 3–6 months postoperatively when soft tissue swelling may have led to the increase in nasal width found[13,14]. van Loon et al. found that there was still widening of the nose with a cinch suture after 12 months[11]. The sample size of that study was limited to 13 patients only, with no long-term effects documented beyond the 12 months. The authors also mentioned an advantage of intraoperative measurements of the nasal width, which the present study aimed to address.

Although the short-term effects are well documented, very few studies have looked into the long-term effects on the nasal width, including the long-term stability of the cinch suture. The existing literature focuses on follow-up ranging from 6 to 12 months when soft tissue swelling may still be evident. One study that did try to determine this was performed by Stewart and Edler[8], who found that the cinch suture helped control alar flaring for 28 patients at the time of operation and that