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The influence of a Le Fort I impaction and advancement osteotomy on smile using a modified alar cinch suture and V-Y closure: a prospective study

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Abstract. A previous report from the authors' department showed that a modified alar cinch suture combined with a muco-musculo-periosteal V-Y closure (mACVY) improves nasolabial mobility. To test if the improvements were equal to the range of nasolabial mobility in non-dysgnathic persons, a prospective study was carried out in 56 patients: 31 with mACVY, 25 with simple closing sutures (SCS) and 18 non-operated, angle class I volunteers. Standardized full facial frontal photographs, taken immediately preoperatively and 18 months postoperatively were used. The landmarks, alare, crista philtri and cheilion were analysed. The test has a standard deviation of 0.9 mm. Intra-group changes, paired *t*-test, and inter-group differences, unpaired *t*-test ($p < 0.05$) were statistically analysed. The results show significant preoperative differences in nasolabial mobility compared with the control group, for both groups. Postoperative mobility improved in both groups, but significantly with mACVY with horizontal movement of cheilion and alare, and the vertical movement of crista philtri and less so for the vertical movement of crista philtri with SCS. Postoperative inter-group differences in mobility were small and significant for SCS *vs* the control group. It can be concluded that using mACVY improves orofacial movement to the level of normal class I volunteers.

Keywords: nasolabial dynamics; Le Fort I osteotomy; alar cinch sutures; V-Y closure; orthognathic surgery.

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Nafziger[12] reported that dysgnathic patients had a smaller range of motion of the perioral structures compared with non-dysgnathic persons. One of the goals of orthognathic surgery should be to increase nasolabial mobility to the 'normal range'. Le Fort I osteotomies have a tendency to create unwanted side-effects in the nasolabial soft tissues such as broadening of the alar base, loss of vermilion show of the upper lip[5,7,8,15–17,19–21,23] and the corners of the mouth sloping down[1,15]. A muco-musculo-periosteal closure, in a V-Y fashion, of the vestibular incision has been suggested to prevent these adverse effects on the lip[2,15,19,20]. It has been postulated that the combination of the V-Y closure with an alar base cinch suture

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could minimize the broadening of the alar base[3,15,20].

Retrospective studies have shown that there are no significant differences to be seen in the soft-tissue–bone ratio between simple wound closure and V-Y closure[19], or alar cinch sutures with or without V-Y closure[16].

In a preliminary study it was shown that a modified alar cinch suture in combination with a muco-musculo-periosteal V-Y closure (mACVY) had the potential to improve nasolabial mobility after Le Fort I osteotomies[11]. This was the reason for a prospective study on a large group of patients. The hypothesis was that using mACVY in patients who underwent a Le Fort I impaction osteotomy improved nasolabial movement.

Materials and methods

This prospective study comprised 63 consecutive patients (39 female, 24 male) varying in age from 15.4 to 47.9 years (mean 26.9 ± 9.8 years), who had a maxillary vertical hyperplasia with or without an anterior open bite. Eighteen non-dysgnathic, angle class I volunteers were included. None of them had undergone previous osteotomies or suffered from a known craniofacial syndrome. All patients underwent a Le Fort I intrusion osteotomy. Stabilization was achieved with four 1.5 titanium microplates and screws (KLS Martin, Tuttlingen, Germany). The first series of patients ($n = 33$) had a modified alar cinch suture[9] combined with a mACVY closure. The modification included a 2×0 Vicryl® suture through the levator and nasal muscles including the periosteum and passed through the nasal septum approximately 10 mm posterior to the anterior nasal spine. After passing the paranasal muscles and periosteum, the suture was run back through the nasal septum again to the original entrance side and tied. The V-Y closure included a suture, 3×0 Vicryl®, through the muscle and periosteum resulting in approximately a 15 mm long tail of the Y. In the next series of patients ($n = 30$) a simple mucosal closure was carried out using 3×0 Vicryl® (SCS).

Cephalometric radiographs were available of all patients preoperatively and 12 months postoperatively. All radiographs were digitized as separate data files with the Dentofacial planner Plus 2.02 programme (Dentofacial Software Inc., Toronto, Canada) with a Hi-Pad DT11 digitizing Tablet (Houston Instruments Inc., Austin, TX) on a Tecra 8000 Pentium II 266 MHz computer (Toshiba Europe GmbH, Regensburg, BRD) by one investigator (MSMM). The relevant lines and points measured are depicted in Fig. 1.

The maxillary movements of the two groups (SCS and mACVY) were compared and a paired *t*-test was used to define the significance, at a level of $p < 0.05$.

For the soft-tissue analysis two series of facial photographs were made in a standardized manner. This was done in two separate sessions: just before and 18 months after operation (T_0 and T_1) by one investigator (MSMM). The patients and volunteers were seated on a height-adjustable chair and the heads were fixed in a cephalostat with a nasal bridge support adjustable for the sagittal and vertical position. The preoperative position was easily copied 18 months later. A Yashica Dental Eye II (Kyocera Corporation, Tokyo, Japan) camera was fixed to the cephalostat with the focus centred at the nasal bridge support and a focus object distance of 1755 mm.

The landmarks (Fig. 2) on the upper lip were marked with a sharp eye-pencil, producing markings with a diameter of about 1.5–2.0 mm. A series of photographs on Kodak ASA 200 film were made in the following manner. The patients and volunteers were asked to pronounce the letter M after which they had to get their molars in a gentle occluded position. Subsequently the first photograph in 'repose' was made (Fig. 3). For the next photograph they were asked to produce a 'maximum closed mouth smile' (Fig. 3)[6]. The procedure was repeated with the surgical patients 18 months postoperatively and the sharpest prints were used for analysis.

The photographs were printed on a transparent sheet at full size. The corresponding full size pictures were superimposed on the eyes and digitized as separate data-files using the Dentofacial planner Plus 2.02 programme by one investigator (MSMM). Two sets of photographs were made including T_0 ClosedSmile preop ('repose' *vs* 'closed mouth smile') and T_1 ClosedSmile postop ('repose' *vs* 'closed mouth smile'). For the volunteers only one set was made: ClosedSmile ('repose' *vs* 'closed mouth smile'). Landmarks used for analysis are presented in Fig. 2.

A two-dimensional coordinate system was used to calculate the differences between the subsequent acquired data of linear measurements of the corresponding landmarks on the pictures. A horizontal axis was drawn through both medial canthi. The *y*-axis was constructed perpendicular to this line but 30 mm to the right (Fig. 2).

The excursions for the 'maximum closed mouth smile' were calculated for the SCS and mACVY group pre- and postoperatively, and for the volunteers. They were also calculated as percentages

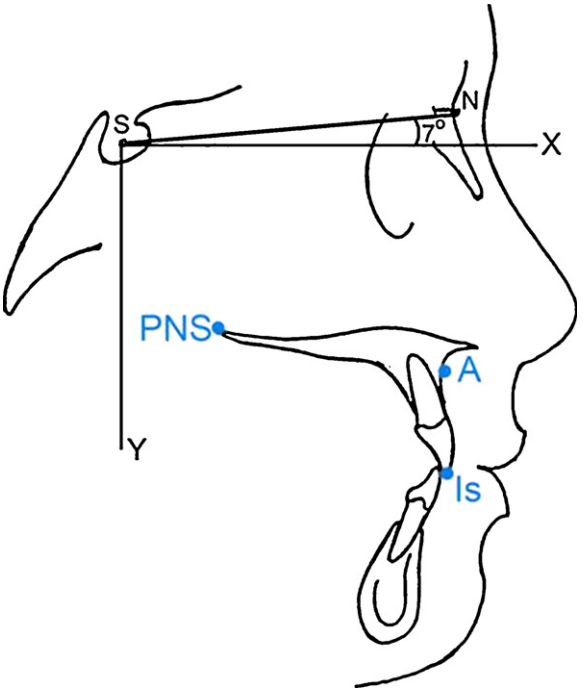

Fig. 1. Landmarks and two-dimensional coordinate system used for the analysis of osseous movements on lateral cephalograms. Sella (S), nasion (N), A-point (A), posterior nasal spine (PNS), upper incisor (Is).