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STABILITY OF MAXILLARY OSTEOTOMIES IN CLEFT PATIENTS APPROACHED VIA MINIMAL INCISIONS AND FIXATED WITH MINIPLATE-OSTEOSYNTHESIS AND MONOMAXILLARY SPLINTS WITHOUT POSTOPERATIVE INTERMAXILLARY FIXATION

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Abstract

This prospective study presents the stability obtained following maxillary osteotomies in cleft maxillary deformities approached via minimal incisions and fixated with miniplates and monomaxillary splints without postoperative intermaxillary fixation.

The maxillary osteotomies in 1, 2 or 3 pieces in 12 cases of unilateral cleft lip and palate (UCLP) and 8 cases of bilateral cleft lip and palate (BCLP) were carried out consecutively in 12 male and 9 female patients, varying in age between 17 and 21 years.

The buccal incision does not extend beyond the first bicuspid. In the unilateral cases, the palatal soft tissue layer was kept intact. Maxillary fragments were stabilised with miniplate osteosynthesis, bone grafts and a reinforced overcorrection splint, without postoperative intermaxillary fixation.

Cephalometric analysis showed an average advancement in the Incisor point of 4.3 mm (maximum 11 mm) and in A-point of 6.4 mm (maximum 11.5 mm) whereas the average advancement of the major segment was 7.1 mm (maximum 12 mm) and 11.2 mm (maximum 19 mm) for the minor segment. Average relapse tendency after one year was 0.8 mm in Incisor point and A-point. No relapse of cross-bite occurred. The stigmatising midface and paranasal concavity was corrected in all cases.

The method described is reliable and permits the correction of the cleft maxillary midface deformity in a predictable way. Reopening of the palate is not necessary in order to mobilise the segments. Postoperative rigid intermaxillary fixation is not mandatory for obtaining skeletal stability.

Introduction

Although adequate primary cleft operation techniques and timing allow for sufficient maxillary growth in 80% of unilateral cleft lip and palate (UCLP) and over 90% in bilateral cleft lip and palate (BCLP) to avoid clinically relevant maxillary hypoplasia in the series treated according to the Zurich protocol, maxillary osteotomies still have their indications.[1,2]

Apart from varying degrees of maxillary arch collapse, malocclusion and dentofacial deformity, UCLP and BCLP patients may present with horizontal and vertical maxillary deficiency. The adult skeletal cleft deformity is variable and is related both to the severity of the original embryological defect and to the pattern of primary surgery and subsequent orthodontics. Retromaxilla is the most relevant element contributing to the facial "stigma" of cleft patients, and therefore should be corrected entirely if one wants to correct the cleft deformity further by surgical corrections of lips and nose. Obwegeser revolutionised and standardised the skeletal correction of maxillary cleft deformities by developing the segmented Le Fort I osteotomy, in which 2 or 3 segments are advanced in one single session.[3-5] Alternatively this segmented Le Fort I osteotomy should be combined with Le Fort III osteotomies in case of extreme maxillary hypoplasia involving the infraorbital rim and thus causing exophthalmia.[6,7] This prospective study presents the stability obtained following maxillary osteotomies in 2 or 3 pieces approached via minimal incisions, fixated by means of miniplates and splints without postoperative intermaxillary fixation.

Material and Methods

Patient sample

This study was carried out in 21 patients, 12 males and 9 females, operated on between July 1994 and March 1996. Their average age was 18.6 years (range, 16.8 to 20.3 years). There were 14 patients with unilateral clefts and 7 with bilateral clefts. Thirteen in 21 patients had been treated primarily according to the Zurich protocol (8 of 15 patients with UCLP and 4 of 6 with BCLP).[8,9] Three patients had undergone early secondary bone grafting prior to eruption of the canine and 3 others, late secondary bone grafting. Preoperative orthodontic coordination was performed in all patients but 3, whose dental arches were congruent following earlier orthodontic treatment. There were 23 diastemas in the 28 cleft sites.

The UCLP group was divided into group A1, operated according to the Zurich protocol, and group A2, operated according to other protocols. Both subgroups had a retromaxilla with group A1 having an SNA angle of 78.2° and group A2, 76.9°. In the first group, the ANB was -0.8° and in A2, it was -0.7°. Nine patients presented with cross bites. Eleven patients showed diastemas in the cleft area, 9 of which were closed surgically. The sagittal position of the premaxilla was better in the bilateral group with an SNA of 79.0°, as was the skeletal convexity with an ANB of 2.3°. All 7 patients presented with cross bite, 3 of them bilaterally. Five patients had bilateral and 2 had unilateral diastemas. Four patients were excluded from the follow-up study; one with missing premaxilla, one with hypertelorism and two with incomplete data.

Surgical technique

The surgical concept aims for minimal incisions and degloving, allowing for maximal conservation of the blood supply, both from the greater palatine artery and from the buccal pedicles. Moreover, unnecessary incisions and reopening of the palatal mucoperiosteum is avoided. The incision does not extend beyond the first bicuspids. In cases without secondary bone grafting, the buccal aspect of the alveolar cleft is excised and the scarry soft tissues removed, whereas the palatal soft tissues beyond the alveolar cleft are kept intact. During gradual opening of the down-fracture gap, the cleft scar is separated with scissors from the nasal soft tissues and the nasal layer is reconstructed. Maxillary fragments are stabilised with miniplate osteosynthesis, bone grafts and a reinforced overcorrection splint, without postoperative intermaxillary fixation.

In the case of BCLP, the incision runs from above the first bicuspid towards the cleft and from there, behind the premaxilla to the other side. The premaxilla is fractured and luxated laterally and anteriorly, pedicled on a broad vestibular pedicle. The osteotomy of the posterior segments is done without opening the palatal mucosa which is mobilised from intranasally following down-fracturing. The splint is ligated over the brackets and remains for 6 weeks. Titanium miniplates are placed along the piriform aperture and at the zygomatic buttresses. Bone gaps are filled with autologous bone.

Examination methods

Lateral cephalograms were made preoperatively, immediately postoperatively and 12 months postoperatively. Points S, N, A, I, ANS, PNS and B were digitised on the cephalograms, which were superimposed. The distances of A, I, ANS and PNS to the reference axes X and Y were measured. The X-axis coincides with the Frankfort horizontal reference plane, the Y-axis with its perpendicular through S. The positive values are directed anteriorly and caudally.

The relapse of the maxilla in the antero-posterior and vertical planes was determined by the movement of point A. The rotational maxillary relapse was determined by the changes of the nasal plane defined by the ANS and PNS. The changes in facial convexity were measured by analysing the values of the angles ANB and SNA.

The changes in the transverse plane were evaluated from casts made preoperatively, the model surgery cast and at the latest follow-up. The differences in the cuspid, bicuspid and first molar distances were measured.

Results

In 4 patients a Le Fort I osteotomy in one piece was performed; in 10 patients a Le Fort I in 2 segments and in 7 patients, in 3 segments. Nine patients underwent simultaneously bilateral mandibular sagittal split osteotomies and genioplasties; 6 patients, bilateral sagittal split osteotomies only and 3 patients, a genioplasty.

Thirteen of the 23 diastemas were closed surgically. Infections and wound dehiscences did not occur. The 3 preoperatively present oronasal fistulae in the alveolar cleft area in patients without secondary grafting were all closed and there were no newly created fistulae postoperatively.

In UCLP group A1, the average surgical advancement in A was 6.2 mm. The average extrusion in ANS was 4.6 mm, whereas in general, the position of PNS did not change vertically (average -0.2 mm). This corresponds with the rotational movement of the maxilla by posterior impaction or anterior extrusion in order to correct the paranasal concavity. Convexity was cephalometrically restored by increasing the angle ANB from -0.8° to 5.9°, and by increasing SNA from 78.2° to 84.2° postoperatively (Table 1).

The small segment was averagely advanced 11.1 mm (maximum 19.0 mm) and the non-cleft side 7.1 mm (maximum 12.0 mm) (Table 2). In group A2 the movements were similar for all parameters mentioned, except for a slightly greater advancement. In the BCLP group, A-point was displaced 1 mm anteriorly and 3.1 mm caudally. The preoperative values of SNA (79.0°) and ANB (2.3°) were better than in the patients with UCLP deformity, but were less corrected (80.2° and 5.5°).

The surgical widening in the canine area in group A1 was 2.0 mm and 2.3 mm in group A2. The intermolar distance was 2.1 mm and 2.5 mm respectively. The widening of the intercanine distance in group B was more important (3.7 mm) which is due to the bilateral cross bite in the canine area, and equal for the intermolar distance with 2.5 mm (Table 2).

Table 1. Surgical movement and relapse of the maxilla.

Group A1	A		ANS		PNS		SNA	ANB
	X	Y	X	Y	X	Y		
FR 2 - FR 1 ^m	6.2	4.1	3.3	4.6	3.2	-0.2	78.2° + 6.0°	-0.8°+ 6.7°
SD	±3.0	±3.6	±3.8	±4.1	±3.9	±1.7	±3.5°	±3.7°
FR 3 - FR 2 ^m	-0.8	-0.8	1.2	-0.5	1.0	-0.1	84.2° -0.7°	5.9° -1.7°
SD	±2.1	±1.2	±2.0	±1.2	±1.1	±0.8	±1.9°	±2.0°
Group A2	A-point		ANS		PNS		SNA	ANB
	X	Y	X	Y	X	Y		
FR 2 - FR 1 ^m	6.8	2.7	5.8	2.5	8.4	0.4	76.9° + 7.1°	-0.7°+ 6.5°
SD	±3.8	±1.4	±4.6	±2.5	±3.3	±3.1	± 4	± 3.0°
FR 3 - FR 2 ^m	-2.0	-1.5	-2.8	-2.9	-1.0	-0.3	84.0° -2°	5.8° - 3.0°
SD	±0.7	±1.9	±2.4	±1.8	±1.4	±0.4	± 0.6	± 0.8°
Group B	A-point		ANS		PNS		SNA	ANB
	X	Y	X	Y	X	Y		
FR 2 - FR 1 ^m	1.0	3.1	1.4	1.5	2.3	-0.1	79.0° + 1.2°	2.3°+ 2.7°
SD	±2.8	±5.1	±4.3	±2.0	±2.0	±1.9	±1.2°	±5.5°
FR 3 - FR 2 ^m	0.1	-0.4	-1.9	-0.4	-0.9	-0.6	80.2° + 0.3°	5.0° -1.4°
SD	±1.0	±0.7	±1.0	±0.7	±2.2	±1.9	±0.9°	±1.9°

Table 2. Overview c

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Surgical widening ^
SD
Postop change ^m
SD
Group A2
Preoperative distanc
SD
Surgical widening ^
SD
Postop change ^m
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Preoperative distanc
SD
Surgical change ^m
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Postop change ^m
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Table 2. Overview of surgical and postoperative transversal changes of the maxilla.

Group A1	Intercanine distance	Interbicuspid distance	Intermolar distance
Preoperative distance ^m	29.25	40.5	48.4
SD	± 3.29	± 3.54	± 3.31
Surgical widening ^m	+ 2.04	+ 2.0	+ 2.12
SD	± 1.57	± 1.63	± 1.47
Postop change ^m	- 0.33 16%	- 0.25 12.5%	- 0.75 35%
SD	± 0.47	± 0.25	± 0.25
Group A2	**Intercanine distance**	**Interbicuspid distance**	**Intermolar distance**
Preoperative distance ^m	30.9	35.0	47.6
SD	±4.29	± 1.2	± 4.45
Surgical widening ^m	+ 2.33	+ 3.1	+ 2.5
SD	± 2.98	±1.2	± 0.45
Postop change ^m	-0.83 33%	- 1.3 42%	- 0.9 36%
SD	+ 0.55	± 0.93	± 1.2
Group B	**Intercanine distance**	**Interbicuspid distance**	**Intermolar distance**
Preoperative distance ^m	31.75	36.8	45.6
SD	± 3.13	±4.09	± 5.11
Surgical change ^m	+3.69	+ 2.7	+ 2.5
SD	± 3.62	± 2.31	± 0.77
Postop change ^m	- 1.66 44%	- 0.62 22%	- 1.94 77%
SD	± 0.62	± 0.41	± 0.86

In group A1 the average relapse in point A was -0.8 mm, directed cranially and dorsally. The relapse rates for ANS and PNS in the horizontal plane were -1.2 mm and -1.0 mm and in the vertical plane -0.5 mm and -1.2 mm. The corrected SNA value remained rather stable (-0.7°) and there was a slight reduction of the ANB angle (-1.7°). In group A2 the average values in the horizontal and vertical plane in A were -2.0 mm and -1.5 mm. The SNA value was reduced by 2° from 84.0° immediately postoperatively to 82.2° and the relapse of ANB was 2.8°.

In the BCLP group, the A-point remained stable. The SNA angle also remained stable, whereas the ANB angle decreased on the average, 1.4°, leaving an ANB value of 3.6°.

The transverse relapse tendency of the intercanine width in groups A1, A2 and B was -0.33 mm, -0.83 mm and -1.66 mm respectively, corresponding with 16%, 33% and 44% of the surgical enlargement. In the molar area the values for the 3 groups were -0.75 mm, -0.9 mm and -1.94 mm respectively, corresponding with 35%, 36% and 77% of the enlargement. However, no relapse of cross bite occurred because of the use of transversal overcorrection splints. Moreover, in some cases the intermolar distance was reduced orthodontically to optimise occlusion.

In all patients there was evident correction of facial convexity with good support for the nasal alae and all occlusions remained stable.

Discussion and Conclusion

Although the average SNA value in group A1 with 78.2°, in group A2 with 76.9° and in the BCLP group with 79.0° is less pronounced than the average value of 73.6° reported by Semb in 1991, midfacial

concavity in our series was still part of the facial stigma and was therefore corrected surgically.[10] The technique with minimal incisions yet allowing for direct view of the operation site allows for major displacements as well as maximal vascularisation of the segments. Moreover, the strictly limited approach of the palate avoids new scar formation, which is one of the relapse factors. Apart from a postoperative intrusion of about 1 mm, the surgical results were stable. In the patients not operated according to the Zurich protocol, the surgical movements were slightly greater and the relapse tendency was more important. The clinical relevance of the transverse relapse tendency in group A1 is minimal. For group A2 and the bilateral cleft group, this was neutralised by the transverse overcorrection splints and no postoperative cross bites occurred.[11] Postoperative rigid IMF was revealed not to be necessary in this group of patients.

In all patients there is evident correction of the facial convexity, which was enabled by the maxillary rotation advancing more the nasal aperture than the incisors. Thus, basic conditions for further correction of the facial stigma by secondary lip and nose corrections are fullfilled.

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