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RESEARCH ARTICLE

COMPARATIVE STUDY TO ASSESS EFFICACY OF LEVERAGE TECHNIQUE V/S SHAMS TECHNIQUE IN LEFORT I OSTEOTOMY DOWN FRACTURING

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ABSTRACT

Lefort 1 osteotomies are very commonly performed orthognathic surgical procedure and is of wide application in correcting dentofacial deformities. The down fracturing technique of maxilla is an important step in Lefort osteotomy and is associated with occasional trouble shooting.

Aim of the study: was to evaluate the ease of two down fracturing techniques –by using a 0.5 mm stainless steel wire traction and using modified leverage technique using two periosteal elevator and chisel.

Patients and methods: 42 patients who reported to the department of oral & maxillofacial surgery for correction of maxillary deformities requiring lefort 1 osteotomy were selected for the study. 21 patients underwent down fracturing using stainless steel wire and 21 patients underwent down fracturing using modified leverage technique. The techniques were compared for the time taken for down fracture, lateral movement obtained after down fracturing and associated complications.

Results: The comparison between two groups showed no significant difference in the time taken for down fracturing the maxilla. The lateral movement of maxilla after down fracturing was more in technique with stainless steel and was statistically significant. The leverage technique had two cases with wrong split of maxilla, where as mucosal tear and breakage of anterior nasal spine was noted in stainless steel technique.

Conclusion: Both the techniques provided efficient down fracturing however technique of using stainless steel provided additional benefit of greater amount of lateral movement and helped in holding into position during rigid fixation.

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INTRODUCTION

Beauty and perfection are always admired by every human being. Man has devised several methods to correct the imperfections affecting beauty. The history of orthognathic surgery to correct dentofacial jaw deformities dates back to early 1846. This involved altering the position of maxilla and or mandible. Lefort I osteotomy to mobilize the maxilla was first performed for the purpose of removing a nasopharyngeal polyp by Von Langenbeck. In 1867 Cheever performed a maxillary osteotomy to remove nasal obstruction. Maxillary fracture line pattern were described by Rene lefort in 1901 by his classic studies on human cadavers. Many segmental osteotomies were performed in the early decades of nineteenth century. Cohn-Stock (1921) performed a segmental osteotomy and was modified by Wassmund (1926) Cupar (1954) and Wunderer (1963) by a palatal approach. Axhausen (1934) performed total mobilisation of the maxilla.

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The lefort 1 maxillary osteotomy for mobilization and repositioning of maxilla is an important step during this procedure. The surgeon may sometimes find difficulties to initially mobilize the maxilla after the osteotomies are completed. Various techniques are used for the initial mobilisation and down fracturing of the maxilla from the pterygoid plates. This includes digital pressure to the dentoalveolar region, disimpaction forceps, smith spreader, tessier osteotomes and other instruments. Out of these techniques commonly used technique is digital pressure application over the anterior part of maxilla. Lot of refinements in surgical techniques and instrumentation have developed in the last two decades and osteotomies is much safer nowadays. In our study two newer down fracturing techniques were compared for their efficacy. The aim of the study was to evaluate the ease of two down fracturing techniques. One by using a 0.5 mm stainless steel wire traction (Shams method) and second method was modified leverage technique, suggested by Eber L.L Stevao and Larry. M. Wolford in which two curved freer periosteal elevators along with a nasal septal osteotome is used. The two techniques are compared on the

time taken for down fracturing, safety, advantages and complications.

PATIENTS AND METHODS

The study was conducted in the department of Oral & Maxillofacial Surgery, Government Dental College, Calicut between the year 2013 -2015. Twenty one patients reported to the department of Oral and Maxillofacial Surgery, Government Dental College, Calicut for correction of maxillary deformities which required lefort 1 osteotomy were selected as study group. In this group down fracturing technique using stainless steel wire were employed. Another group of 21 patients who reported in the same period were selected as control group and down fracturing was done using modified leverage technique. All the patients were thoroughly evaluated clinically, and radiographicaly before general anesthesia. Patients requiring lefort 1 osteotomy as per the treatment planning and willing to participate in the study were included. Patients with cleft palate are excluded from the study. In both groups various parameters like time taken for down fracture, lateral movement obtained after down fracturing and associated complications were registered.

Surgical procedure

Pre surgical orthodontics was carried out in all patients for arch alignment and space closure. Surgery was performed under general anesthesia through nasoendotracheal intubation using nasal RAE tube. Lignocaine with adrenaline in the dilution of 1:20000 was infiltrated for haemostasis. A horizontal soft tissue full thickness periosteal incision from the buttress of zygoma to the buttress of other zygoma with a V notching at the midline was placed over the buccolabial aspect of depth of vestibule. The margins of the superior flap raised to expose the entire lateral wall of maxilla zygomatic buttress, infra orbital foramen and pyriform aperture. The soft tissue of the nasal pyriform aperture reflected and nasal mucoperiosteum elevated. Osteotomy was done with fissure bur and completed with guarded nasal osteotome and pterygomaxillary osteotome. In the 21 patients of the study group after the completion of the maxillary horizontal bone osteotomies and separation of the tuberosities from the pterygoid plates, the mucoperiosteum is elevated completely from the nasal floor, base of the nasal septum and lateral nasal walls using periosteal elevators. The osteotomies of these areas completed using lateral and medial nasal osteotomes. Then while protecting the nasal mucosa with a periosteal elevator, an elongated bur hole is drilled through the base of the nasal spine. Then, a 25-35 cm segment of 0.5 mm stainless steel wire is passed through the hole and pulled out from the base of the anterior nasal spine and then twisted with wire holder pulled one hand using a forward and downward vector of force to downfrcture the maxilla while the other hand retracts the upper lip and supports the face by pressing on the maxillary buttresses. After initial vertical dysjunction of the maxilla, lateral traction on the wire helps complete the mobilization when forward leverage is applied via a curved osteotome at the pterygomaxillary junction. The wire can then be used to bring maxilla forward into the desired position if required as in the case of maxillary advancement or to hold it downward while rongeur or rose burs are used for bone reduction (when positioning maxilla superiorly).The wire is cut and removed after the maxilla is repositioned and fixed into final position (Figure 1-6).

Figure 1. Drilling a bur hole through the base of nasal spine

Figure 2. A 0.5mm stainless steel wire passed through the bur hole

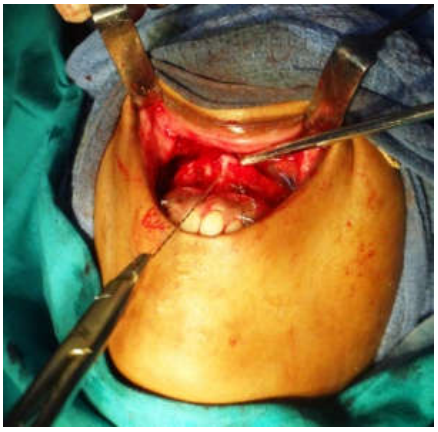

Figure 3. Securing and holding the stainless steel wire with a wire holder

Figure 4. Downward and forward force applied on maxilla

Figure 5. Maxilla down fractured by controlled force

Figure 6. The measurement of downward mobility attained

In 21 patients in the control group modified leverage technique was used for down fracturing the maxilla. Two curved dials periosteal elevator introduced one on each side along the nasal floor between the bony nasal floor and nasal mucosa. The dials periosteal elevators were left in place to elevate nasal mucoperiosteum and to protect it from damage while the nasal septum was separated from maxilla. The nasal septum detached from superior aspect of maxilla by using a double guarded nasal septal chisel placed using an oteotome. Holding these three instruments together with one hand the maxilla was mobilized in a downward rotation move. Slowly increasing the inferior pressure on the anterior portion of the maxilla resulted in complete down fracturing (Figure 7-10). After down fracturing, maxilla is mobilized and amount of movement possible in lateral and anteroposterior directions assessed. This was measured using a flexible metallic scale in millimetres taking midline of maxilla as reference point and compared. Time taken for down fracturing in both the techniques were also assessed. The time is assessed in seconds and is measured as the time taken from the completion of osteotomy cuts to down fracturing the maxilla. This was measured using a stopwatch. Any complications which arised during the down fracturing also was assessed. A thorough evaluation is done to assess any wrong split, nasal mucosal tear, breakage of thin bony rims, teeth avulsions etc and recorded. In cases of incomplete split or unsuccessful down fracture all the osteotomy sites were inspected and osteotomy were refined again before attempting down fracture. This will ensure that untoward complications will not arise due to inadvertent application of force. All the values were then statistically evaluated using chi-square test for qualitative assessment and student t test for the quantitative assessment of the techniques. Maxilla was fixed with miniplates and screws. Haemostasis is achieved before suturing is undertaken.

Figure 7. The completed osteotomy

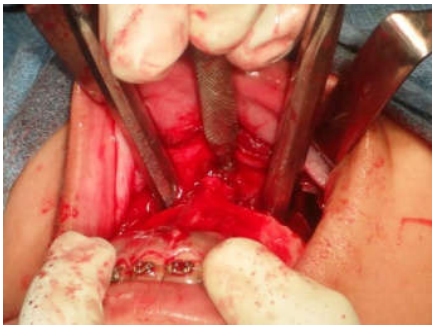

Figure 8. The two periosteal elevators on either side and nasal septal chisel at the centre

Figure 9. Downward rotation movement applied by holding the three instruments on one hand

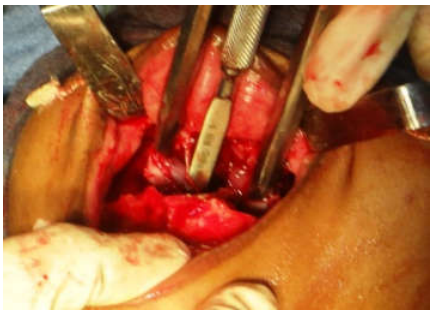

Figure 10. The maxilla down fracture attained

Mucosal incision was then closed with 3-0 interrupted vicryl sutures. All patients were put on antibiotic and analegsics and steroids.All patients were discharged on fifth day and were subsequently followed up for sixmonths.

RESULTS

There was ten patients were male and thirty two patients were females (Table 1). The mean age of the patient in the study group was 27 years.

Table 1. Gender distribution

Gender group	No. of cases (%)	Percentage
Group1 (Male)	5	
Group1 (Female)	16	
Group2 (Male)	5	
Group2 (Female)	16	
TOTAL	42	100.0

Time taken for maxilla down fracture and the lateral movements obtained evaluated and compared using student t test. The comparison between two groups showed no significant difference in the time taken for down fracturing the maxilla. The technique using stainless steel wire showed more lateral movement and found to be statistically significant. The technique also had additional benefit of helping in holding into position during rigid fixation (Table 2, 3).

Table 2. Time for down fracturing and lateral movements

Group		N	Mean	Std. Deviation
Time for down fracturing	1	21	160.00	25.249
	2	21	166.19	32.323
Lateral movements	1	21	5.14	. 854
of maxilla (mm) Rt	2	21	27.38	4.189
Lateral movements	1	21	5.10	1.136
of maxilla (mm) Lt	2	21	28.00	3.521

Table 3. Statistical analysis of time and lateral movements

	t-test for Equality of Means		
	t	Df	Sig. (2-tailed)
Time for down fracturing Equal variences assumed	-.692	40	.493
Lateral movements Equal variences assumed of maxilla(mm)Rt	-23.838	40	.000
Lateral movevement Equal variences assumed of maxilla (mm)Lt	-28.368	40	.000

Complications associated with both techniques were also recorded.Using leverage technique two wrong split of the maxilla was noted. 2 cases of mucosal tear and 3 cases of breakage of anterior nasal spine was observed in stainless steel traction technique. Overall incidence of complications using both the techniques were negligible (Table 4). The complications were compared using chi square test and was not statistically significant with a p value of 0.071.

Table 4. Complications in both groups

Group	Complications				
	Breakage of ANS	Mucosal tear	Wrong split	Nil	Total
1 Count % within group	0	2	2	17	21
	0%	9.5%	9.5%	81.0%	100.0%
2 Count % within group	3	0	0	18	21
	14.3%	.0%	.0%	85.7%	100.0%
Total	3	2	2	35	42
Count % within group	7.1%	4.8%	4.8%	83.3%	100.0%

DISCUSSION

Maxillary down fracture procedure in lefort 1 osteotomy was performed early in 1867 by David W Cheever (Cheever, 1870). Inability to completely mobilize the maxilla and relapse were the common difficulties of the operation. Many refinements and advent of sophisticated instruments have improved the techniques of lefort osteotomies in the last two decades. For down fracturing of the maxilla during lefort 1 operation many methods were employed. Using digital pressure on the anterior maxilla down fracture can be performed but requires greater force for mobilisation because of poor leverage mechanics. During this inadvertent stripping of the attached gingiva on the anterior maxillary segment, orthodontic band detachement, injury to operators fingers, or luxation of the incisors can occur. Rowes disimpaction forceps can provide good downward leverage mechanics, but can bruise or crush the palatal mucosa during manipulation. In the technique of using Tessier spreader, Smith three prong spreader or Turvy maxillary expander can provide good mechanical leverage but maintains the risk of inadvertent fracturing of the relatively thin bone at the pyriform rim region (Lanigan and West, 1984). Newly designed Martin modified Obwegeser bone separator is also used in down fracturing of maxilla. The hinge design of the instrument allows surgeon to insert the head of the instrument between the osteotomy cut and deliver equal controlled force during downfracture. The availability and the cost of the instrument and the risk of fracturing of thin bone at pyriform rim limits use of this technique. So considering the various troubleshooting which can occur with the above mentioned techniques a simpler and safer method to facilitate down fracturing of the maxilla would be beneficial.

In our study using both the methods down fracturing was completed in a relatively quick time.Ensuring that all bone cuts are completed before attempting down fracturing is mandatory. This will avoid occurrence of many complications like wrong splits, mucosal tear and hemorrhage etc. Only very few complications were observed in our study series. Three cases of wrong splits were observed with the modified leverage technique. This could be attributed to the incomplete osteotomy cuts. In both the technique as no instrumentation was carried out in the palatal region during down fracturing no palatal tear of mucosa were reported in our study. The fracture of pyriform rim and zygomatic buttress did not occur using the techniques employed in our study as the forces of down fracturing are not transmitted to the osteotomised rim of the bone. In the leverage technique down fracture of the osteotomized maxilla was carried out in a much simplified way as not much manipulation was required in this region. Loading arms were short compared to the leverage arm and this is the principle of giving good mechanical advantage as in the first order lever. This modified leverage technique distributes the loading forces more evenly over the nasal floor and maxillary crest regions diminishing heavy forces to isolated regions that occur with other methods. This also decrease the occurrence of unfavourable fractures at the pyriform rim region or inadvertent mobilisation of the anterior segment. This method allows for a quick method for maxillary mobilisation using instrumentation that is used during the normal course of performing the lefort 1 osteotomy. There were two cases of wrong splits in the maxillary tuberosity area using this technique. In both these cases the osteotomy was refined again to compltetely down fracture the maxilla. The biomechanics of the stainless steel wire technique relates to an obliquely directed resultant vector of bidirectional forces on the maxilla enabling the use of force in a downward and forward direction[3]. This technique also has the added advantage of providing lateral mobilization with lateral traction. This is because the pterygomaxillary junction area can be well mobilized using this traction technique. The lateral movement of more than 3 cm attained can be used in correcting and positioning of asymmetrical cases of maxilla. The completeness or incompleteness of the osteotomy cuts can be

sensed manually and when maxilla is not yielding to traction to the wire the procedure can be stopped and thus wrong splits can be avoided. Another unique feature observed with this technique is the additional aid of the wire in bringing and holding the maxilla in the desired position for recontouring and fixing with mini plates. Nasal spine breaking during traction was observed in three cases and mainly happened in those cases with a weak nasal spine.In such cases drilling deeper into the base of the anterior nasal spine to engage bulk bone can prevent wire cutting through the anterior nasal spine. Mucosal tear occurred which occurred in two cases using this technique was repaired by sutures using 3-0 vicryl.

Conclusion

Minimal complications were observed using both techniques of down fracturing. The stainless wire traction technique provided greater lateral mobilization of maxilla. Both the techniques were very simple to perform and no additional equipments were required. Therefore it can be concluded that these two techniques of down fracturing are simple and safe method and avoids most of the complications. We also recommend further studies with larger series which will eventually help us in performing osteotomies in a precise and complication free method.

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