Original Article

Evaluation of modified nasal to oral endotracheal tube switch—For modified alar base cinching after maxillary orthognathic surgery

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ARTICLE INFO

Article history:

Received 6 June 2016

Accepted 16 March 2017

Available online 23 March 2017

Keywords:

Alar base width

Cinch suture

Endotracheal tube switch technique

Upper lip length

V-Y closure

ABSTRACT

Background: Soft tissue changes secondary to Maxillary orthognathic surgery are many fold. The alar flare is one among them, which affects the appearance of the patient. Cinch suture has been used to prevent alar flare; but the presence of anaesthetic tube hinders cinching. So, the study was aimed to assess an efficacy of modified nasal to oral tube switch technique for modified alar cinching to prevent alar flare after orthognathic and nasal corrective surgeries.

Materials and methods: Patients were randomly allocated in each group, who underwent modified alar base cinching with and without nasal to oral tube switch. Changes in alar base width, upper lip length was measured with Digital Vernier Caliper and nasolabial angle (Cotg-Sn-Ls) on lateral cephalogram at 1st, 3rd, 6th, and 12th months after surgery. The time taken and ease of tube switch were noted. The data obtained were tabulated and interpreted using a test of significance.

Results: Study results showed no statistical significant difference in perinasal soft changes among both groups. But tube switch appears to be beneficial to prevent alar flare.

Conclusion: Modified alar base cinching was performed effectively in patients with a modified tube switch technique. It increased positive results in comparison with non-shift. The technique of tube switch used is effective in prevention of alar flare. Because of small sample size and limited period of follow up, our study suggests multi centre, randomized studies to know the technical difficulties of tube switch for cinching and aesthetic results with varying anaesthetist and the surgeon's experience.

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1. Introduction

Facial appearance significantly influences the social acceptance and psychological well being of an individual. Nose, lips and eyes are very important structures of face contributing towards facial aesthetics.¹ In particular nose has key role in facial aesthetics.^{2,3} Orthognathic surgery improves function as well as aesthetics, both aspects are equally important and achievement of one goal should not be at the cost of other.¹ However maxillary orthognathic and nasal corrective surgical procedures will produce significant soft tissue changes which greatly influence facial aesthetics.^{1–4}

Weir first described alar base flaring in 1892 after Maxillary osteotomy.⁵ Weir also proposed and executed alar base cinch suture to correct un-aesthetic soft tissue changes.⁵ Many published literature reveal benefits of alar cinch.^{6–8} Few modifications were suggested to overcome the conventional

cinching.^{8,9} Extubation for the final tightening of cinch sutures and wound closure suggestions by surgeons were strongly disapproved by anesthetists because of anesthetic mishaps.^{10–12} Alar cinching might be compromised due to the presence of nasal endotracheal tube.¹¹ Intra-operative assessment and measurement of alar base may not be accurate due to distortion of nostrils by endo tracheal tube and tightening of the cinch suture could also be restricted.¹¹ Because of these constraints alar base cinching might become imprecise arbitrary exercise which may not meet patients and surgeons expectations.^{11,12} So, the study was planned to introduce and evaluate the efficacy of modified nasal to oral endotracheal tube switch technique for modified alar base cinching.

2. Materials and method

Fourteen healthy patients were randomly allocated for the study Groups (seven patients in each Group) during the year 2013–2014, among the patients referred to the Department of Oral and Maxillofacial Surgery from Department of Orthodontics and

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Dentofacial Orthopedics for maxillary orthognathic corrective surgical procedures.

2.1. Materials

The study used Lateral cephalogram, Photographs, Digital Vernier Caliper (Fig. 1). Methylene blue skin marker, 2-0 Prolene, 4-0 Vicryl suture material, Flexo-metallic endotracheal tube. McIntosh Laryngoscope, Babcock abdominal clamp was used to hold the tube in place while shifting and Modified zygomatic hook with protective tubing was used for switching the nasal tube into the oral cavity.

2.2. Methodology

Patients between 18–30 years with American Society of Anesthesiology (ASA) class I, II and Mallampati I, II undergoing maxillary orthognathic procedures willing to participate in the study protocol were randomly involved in Group A—Without Switch and Group B—with switch for modified alar base cinching. Patients having cleft lip, palate, history of nasal surgeries, nasal & septal pathology and trauma to facial bones were excluded to prevent bias. All patients were evaluated preoperatively for alar base width (corresponding to the widest distance from junction of alar insertion at alar facial groove seen on frontal view) clinically using Digital Vernier Caliper (Fig. 2). The legs of caliper were placed at the widest distance— point of alar insertion. Vernier caliper was used to measure upper lip length (Sn-Stms) from sub nasale to stomion superioris. Nasolabial angle (Cotg-Sn-Ls) was measured on lateral cephalogram. Nasal & nasopharyngeal airway patency was assessed using nasal endoscopy. Postoperatively, all measurements were repeated at 1st, 3rd, 6th, and the 12th month to enable accurate changes in nasolabial soft tissues.

2.2.1. Tube switch technique

The technique of tube switch used in this study was modified using protected zygomatic hook¹³ in Group B patients for modified alar cinch to prevent alar base flaring. The technique was adopted from the study by Toshitaka Muto.¹² In our study, the technique of switch is modified using available instrument is well explained elsewhere.¹³ The switch has been performed to move the nasal endo tracheal tube into the oral cavity to facilitate accurate and

predictive cinching. The procedure of the switch in this study is as follows, after fixing of bony segments at predetermined points using surgical occlusal stent, the temporary inter maxillary fixation removed to facilitate the switch, in turn helps for proper cinching.¹³ Babcock abdominal clamp was used to stabilize the endo tracheal (ET) tube (Fig. 3). Modified zygomatic hook with protective tubing was used for nasal to oral switching¹³ (Fig. 4). The connector was reattached to the ET tube which was secured to the lower lip/chin area with tape.¹³ Later the modified alar cinch procedure performed in the absence of tube in nasal cavity for accurate cinching.

Prolene (2-0) suture material was used for modified alar cinch and Vicryl (4-0) for V-Y closure of lip in both the Groups. Nasolabial soft tissue changes were assessed at 1st, 3rd, 6th, and 12th month postoperatively. Alar base was marked using methylene blue ink before operation. 2-0 Prolene suture was inserted from levator and nasal muscles, including periosteum and passed through the nasal septum approximately 10 mm posterior to the anterior nasal spine. After passing through para-nasal muscles and periosteum, the suture was run back through nasal septum again to original entrance side and tied. The vestibular incision was closed in V-Y fashion in both the groups. The study considered the absence and presence of nasal tube for the effectiveness of cinch to prevent alar flaring.

3. Results

The mean age of male and female were 19.75 years (SD—2.4) and 22.5 years (SD—3.8) respectively. The total mean age of males and females was 21.71 (SD—4.8) (Table 1). On comparison, the difference of alar base width between Groups A & B (Tables 1 and 2) at different time intervals were statistically not significant, but the upper lip length and nasolabial angle (Table 1) were shown statistically significant results. Nasolabial angle at 1st & 3rd month post-op in Group A mean difference was 0.71° (p value—0.478) and in Group B was mean difference 1.29° (p value—0.343) (Table 2) both were statistically not significant.

4. Discussion

Alar base cinching is essential because of soft tissue changes associated with maxillary osteotomy which includes increased alar

Fig. 1. Showing Digital Vernier caliper used to measure the alar base width and upper lip length.

Fig. 2. Showing clinical measurement of alar base width using Digital Vernier caliper.

Fig. 3. Nasal tube in place with disconnected connector and deflated cuff.
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base width because of periosteal elevation and muscle detachments adjacent to the nose.^{1,2} Surgical oedema also causes base of nose to expand and spatial change of supportive bone in various directions will lead to widening of alar base.^{1–3} In order to prevent these unfavorable consequences corrective procedures like removal of anterior nasal spine, reduction of anterior projection of pyriform rim and lowering of anterior nasal floor were undertaken.^{4–6} These procedures require additional surgical inconvenience and may have unpredictable results.^{4–6} Alar base cinching is difficult because presence of nasal endotracheal tube; which poses problems of intra-operative alar base width measurement. Other

drawback is tightening of cinch sutures restricted by presence of tube. Because of above constraints alar base cinching may become an imprecise, arbitrary exercise which may not meet patient and surgeons expectations.^{11,12} Both nasal and oral intubation limitations and advantages were published elsewhere in the literature.¹³ To overcome these problems, nasal endotracheal tube to oral switch was advocated for effective alar base cinching.^{11–13}

Simple nasal to oral endotracheal tube switch technique without extubation was proposed by Werther et al. in 1993.¹¹ Technique also discussed its indications for the management of simultaneous nasal-septal injuries, jaw fracture repair and bi-maxillary orthognathic surgery with simultaneous nasal surgery.¹¹ Recently this endotracheal tube switch technique from nasal to oral was modified by Toshitaka Muto et al. by using L shaped rolling retractor.¹² Who suggested rigid fixation of osteotomised segments in proper occlusion before tube shift maneuver which facilitates alar base cinch suturing without any hindrance.¹² Difficulty in shifting associated with push-pull motion of tube and complications associated with technique made us to modify tube switch by using protected zygomatic hook. Study of Toshitaka used L retractor with rolling tube, which may not be feasible to use in the oropharynx and is not available in the market. So, we used a readily available zygomatic hook in the maxillofacial surgeon's armory with protective modification using rubber tube and application of local anesthetic gel for smooth sliding of the ET tube while switching from nasal to the oral cavity.¹³ We found this is easy way to switch without any complications.¹³ This technique may be used for esthetic Facial surgical procedures where tube switch is required.

Because of the V-Y closure, upper lip length was increased significantly in both the Groups and (p value 0.002) were statistically significant. The Nasal endotracheal tube was considered to be a cause for insufficient upper lip lengthening to achieve minimal incisal exposure; on comparison Group B does not show a significant increase in upper lip length, so it can be concluded that rather than intra operative difficulty in suturing it will get corrected by natural means of post-operative muscular adaptation. Nasolabial angle was increased to a statistically significant level, as horizontal movement of maxilla had a significant effect on the

Fig. 4. Nasal to oral tube shift by pushing nasal tube and pulling oral part using zygomatic hook and Babcock forceps used to stabilize the tube at the base of tongue. Source: Reproduced with permission from the publisher.¹³

In the present study, there was no statistically significant difference exists in alar base width measurements which might be attributed to sample size. It also depends on the surgeons experience to handle soft tissue closure properly^{6–8} so that it further prevents flaring of alar base and naso labial changes. There are no similar studies published in the literature for the comparison of study results of our technique; but, available studies were described technique only with their observations.^{11,12} The published study recorded the usefulness of technique for facilitation of cinching.^{11,12} In both the studies they have not compared the results statistically with and without tube in the nose.^{11,12} So, our study is unique which assessed efficacy of switch with limited sample size of fourteen patients. Our study warrants more number of patients involving multi-center observations with varying experience of an anesthetist for tube switch to reveal ease of the technique. Anesthetist confidence and consent for the switch are an important factor for the successful procedure. Sometimes it may pose a problem for the patient. It is very important to examine naso pharyngeal airway of all patients for turbinate hypertrophy, nasal deviation, and adenoids to assess ease of tube switch. In our study anesthetist had no problems in switching the tube. In our study time taken to switch was ranged between 20–40 s with a mean of 30 s. The time for switch should be

Table 1
Showing the Comparison of Alar Base Width, Upper lip length (in mm) and Naso-labial angle in Group A (Without Switch) and Group B (with Switch) patients with different time intervals.

Parameters	Groups	Pre-op	1st Month	3rd Month	Mean difference		
					Pre-1st Month	Pre-3rd Month	1st-3rd Month
Alar base width in mm	Group-A	29.46	29.89	30.14	0.43	0.68	0.25
	Group-B	31.17	31.76	32.16	0.59	0.99	0.40
Upper lip length in mm	Group-A	20.71	22.71	23.71	2.00	3.00	1.00
	Group-B	19.17	21.37	20.85	2.20	1.68	0.52
Naso labial angle in degrees	Group-A	89.14°	115.29°	116.00°	26.15°	26.86°	0.71°
	Group-B	93.71°	101.14°	102.43°	7.43°	8.72°	1.29°

Table 2
Showing the mean comparison of preoperative and postoperative changes in mean alar base width, upper lip length and naso-labial angle in Group A (Without Switch) and Group B (with Switch) patients with different time intervals.

Parameters	Time periods of follow-up	Groups	Mean difference	P value
Mean alar base width	Pre-op and 1 month post-op	Group-A	0.43	0.562
		Group-B	0.59	0.399
	Pre-op and 3 month post-op	Group-A	0.68	0.237
		Group-B	0.99	0.454
	1month and 3rd month post-op	Group-A	0.25	0.599
		Group-B	0.40	0.644
	3rd month and 6th month post op	Group-A	0.26	0.599
		Group-B	0.41	0.644
	6th month and 12th month post op	Group-A	0.26	0.599
		Group-B	0.41	0.644
Upper lip length	Pre-op & 1st month post-op	Group-A	2.00	0.004
		Group-B	2.20	0.001
	Pre-op & 3rd month post-op	Group-A	3.00	0.000
		Group-B	1.68	0.002
	1st & 3rd month post-op	Group-A	1.00	0.05
		Group-B	0.52	0.024
Naso-labial angle	Pre-op & 1st month post-op	Group-A	26.15°	0.000
		Group-B	7.43°	0.000
	Pre-op & 3rd month post-op	Group-A	26.86°	0.000
		Group-B	8.72°	0.002
	1st & 3rd month post-op	Group-A	0.71°	0.478
		Group-B	1.29°	0.343

p value less than 0.05 considered as significant.

nose, labial soft tissue, which appeared to follow osseous movements.^{1,2} Pre-op and 3rd month post-op nasolabial angle mean difference in Group A was 26.86° (p value 0.00) and Group B was 8.72° (p value 0.002).

less than a minute to prevent hypoxia.

Within the limitations of the study like limited number of sample size, and single anesthetist performed all switching showed good post-operative outcome. The study performed

Table 3

Showing various procedures performed in the study with measurements of movements both in maxilla and mandible.

s. no	Surgical Procedure	Movements of Maxilla	Movements of Mandible
1)	Anterior Maxillary & Sub Apical Osteotomy	4 mm setback	3 mm inferior repositioning & 3 mm setback
2)	Anterior Maxillary Osteotomy	5 mm setback	–
3)	Anterior Maxillary Osteotomy & Advancement Genioplasty	4 mm setback	4 mm advancement
4)	Anterior Maxillary Osteotomy & Advancement Genioplasty	4 mm setback	4 mm advancement
5)	Anterior Maxillary Osteotomy & Advancement Genioplasty	4 mm superior repositioning	6 mm advancement
6)	Anterior Maxillary Osteotomy & Advancement Genioplasty	4 mm superior repositioning	8 mm advancement
7)	Anterior Maxillary Osteotomy & Advancement Genioplasty	5 mm setback & 3 mm superior repositioning	4 mm setback and advancement
8)	Anterior Maxillary Osteotomy	4 mm setback and 5 mm superior repositioning	–
9)	Anterior Maxillary & Sub Apical Osteotomy	4 mm setback and 4 mm superior repositioning	4 mm setback & 3 mm inferior repositioning
10)	Lefort I Osteotomy & reduction Genioplasty	7 mm advancement	3 mm vertical reduction
11)	Anterior Maxillary Osteotomy	5 mm setback	–
12)	Anterior Maxillary Osteotomy & Advancement Genioplasty	4 mm setback	4 mm advancement
13)	Anterior Maxillary Osteotomy & Advancement Genioplasty	4 mm setback	4 mm advancement
14)	Anterior Maxillary Osteotomy & Advancement Genioplasty	4 mm superior repositioning	6 mm advancement

Table 4

Showing number of Procedures performed on maxilla affecting Nasolabial angle.

Anterior Maxillary Osteotomy	No of cases
setback	7
superior repositioning	3
setback & superior repositioning	3
advancement	1

Table 5

Showing range of movements in various procedures in maxilla.

Anterior Maxillary Osteotomy procedures	Range of Movements	Mean of movements
Setback	4–5 mm	4.4 mm
Superior repositioning	3–5 mm	4 mm
Advancement	7 mm	–

consists of various maxillary advancement, set back and superior repositioning (Tables 3–5) where the nasolabial angle, alar base width, and lip length changes will be influenced by the movements of underlying hard tissue.^{1,2,4} The nature of wound closure which involves adjuvative procedures like lip lengthening will also change the measurements.⁸ The study subjects underwent mean set back of 4.4 mm in 7 patients, superior repositioning of 4 mm in 3 patients and combined superior repositioning with setback in 3 patients and in one patient maxillary advancement of 7 mm (Table 5). The nasolabial angle will become more acute in the advancement and obtuse in the setback.^{1,2,4} These considerations of movements in relation to tube shift is difficult to assess individually. The study has not taken these aspects into consideration for measurements. The proportion of movements in relation to hard tissue is well documented in percentage of soft tissue movements in published literature.^{1,2,4,8} Here our concern of the study was the alar base width with other components to understand the changes associated. Further study is warranted with due considerations to these aspects of movements, so that the benefit of tube switch can be delineated in a better way.

Post-operative nasal endoscopy was not considered in the study.^{11,12} But in our study, none of the patients had any post-operative problems associated with naso pharynx and nor the post-operative bleeding. There was no difficulty in breathing, which indirectly assesses the injury to turbinates or soft tissue area of naso pharynx. The post-operative oro-pharyngeal examination performed in the patients to reveal any bruise or blunt injury because of pulling of the tube. None of the patients showed significant changes in color of mucosa. We could not able to predict

the difficulties associated with switching as single anesthetist performed all switching procedures and nor the study considered to occupy another anesthetist for the procedure. The published literature also not discussed about these issues.^{11–14}

5. Conclusion

The modified alar base cinching can be performed effectively with modified nasal to oral tube switch using available armamen-

tarium; which doesn't require any special instrument. It increases the positive results in comparison with non-shift by facilitating the cinching. The tube switch is an effective technique in the prevention of alar flare. Because of small sample size and limited period of follow up, our study suggests multi center, randomized studies to know the technical difficulties of tube switch and esthetic results after long term follow up.

Funding

None.

Conflict of interest

None declared.

Ethical issues

Informed consent was obtained from all individual participants included in the study.

Acknowledgements

The author thanks to Dr. Nagesh, Dr. P. Ranjit kumar, Dr. P. Raja satish, Dr. K. Phani Kumar, Dr. Anand Vijay, Dr. Prudhvi Raj for their constant support and encouragement during study period. Also thank to Vice Chancellor and Registrar Dr. NTR University of Health Sciences, Vijayawada for providing an opportunity to become Post Graduate student of the university.

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