

Orthodontic Treatment as Determinant of Alveolar Cleft Bone Grafting Success

Gholamreza Shirani^a, Amir Jalal Abbasi^b, Simin Zahra Mohebbi^c, AmirHossein Mirhashemi^d

Abstract

Objective: This study aimed to evaluate the association between orthodontic treatment and success of alveolar cleft bone grafting performed in oral and maxillofacial surgery department of Shariati hospital at least one year after operation.

Materials and Methods: The patient's records and their post-operative radiographs were studied to assess their age, gender, cleft type (unilateral or bilateral), grafting time (secondary, tertiary), orthodontic treatment (No, Yes) and height of bony bridge. The success was defined as a proportion of at least $\frac{3}{4}$ for the remaining bone in new radiograph to post-operative bone bridge height.

Results: Mean age of the patients was 18 years with a range of 10 to 29 years. From the total patients, 52% (n=28) were male and 48% (n=26) were female, 54% had unilateral and 46% had bilateral alveolar cleft. Among the patients, 20 cases (37%) had secondary and 34 had tertiary bone grafting. In general, 59% (n=32) of the patients, had successful alveolar bone grafting. Out of the total 54 patients, 28 cases (52%) were under supervision and treatment of orthodontist. Logistic regression model showed that presence of orthodontic treatment was associated with higher graft success.

Conclusion: Treatment of Cleft lip and palate needs comprehensive surgical and orthodontic management and all the patients must be under supervision and treatment of orthodontists to take benefit of the surgical treatment.

Keywords: Alveolar cleft; Bone graft; success; Secondary graft; Tertiary graft; Unilateral; Bilateral; Orthodontic treatment

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The overall incidence of cleft lip and palate is considered to be 1:1000 of live births in Iran^{1,2} making it one of the most prevalent congenital defects.

Alveolar bone grafting is commonly needed for $\frac{3}{4}$ of these patients and plays a key role in treatment of cleft patients.

^a Assistant Professor, Department of Oral and Maxillofacial Surgery, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran

^b Assistant Professor, Department of Oral and Maxillofacial Surgery, School of Dentistry, Babol University of Medical Sciences, Babol, Iran

^c Assistant Professor, Department of Community Oral Health, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

^d Assistant Professor, Department of Orthodontics and Dentofacial Orthopedics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

Corresponding author:

Dr. Amir J. Abbasi

E-mail: jabbasi@razi.tums.ac.ir

Based on dentition development, alveolar cleft bone grafting is divided into primary (performed in primary dentition period) secondary (in mixed dentition) and tertiary grafting (in permanent dentition period).³ Primary bone grafting at the time of first lip operation and secondary bone grafting at the time of mixed dentition are assumed to deliver optimum craniofacial development.⁴⁻⁶

The success of alveolar cleft bone grafting is important for post-surgery orthodontic treatment, stability and retention of the teeth adjacent to the cleft and improvement of occlusion.⁷ There are different methods available for evaluation of success of the alveolar graft. Most researchers have suggested pre- and post-operation intraoral radiographs.⁸⁻¹² Bergland and coworkers suggested a four-level

classification for quantitative evaluation of the height of intra alveolar septum after grafting.⁵ The success was determined when the height of intra alveolar septum is at least 3/4 of the normal height.

This study aimed to evaluate the association between orthodontic treatment and success of alveolar cleft bone grafting performed in oral and maxillofacial surgery department of Shariati hospital in a context of cleft's clinical characteristics at least one year after operation.

Methods and Materials

Sixty three patients had undergone alveolar cleft bone grafting in maxillofacial department in Shariati hospital between 2005 and 2008. This study was done in 2009, which among 63 cases, 9 patients were omitted because of either unavailability or lack of attendance or being syndromic cases. The patient's records and their post-operative radiographs were studied to assess their age, gender, cleft type (unilateral or bilateral cleft), grafting time (secondary, tertiary) and presence or absence of orthodontic treatment. The patients were called to attend the hospital for a follow-up evaluation by means of a new panoramic radiograph. The height of remaining bone in alveolar cleft in new radiograph was compared to the vertical height of the bone after operation. If the proportion was estimated at least $\frac{3}{4}$, it was considered a successful graft. Logistic regression model was applied to the data and relating Odds Ratios (OR) and 95% Confidence Intervals (95% CI) were calculated

Results

Mean age of the patients was 18 years with a range of 10 to 29 years. Among the patients, 52% (n=28) were male and 48% (n=26) were female. From total patients, 46% (n=25) had unilateral left cleft palate, 8% (n=4) had right (54% for the total unilateral) and the rest (n=25) had bilateral alveolar cleft. From unilateral patients, 11 cases (38%) had failure, 2 cases due to infection after operation and 9 cases due to insufficient alveolar bone. In the group with bilateral clefts 2 and 4 patients had failure because of infection and insufficient bone, respectively. From the total patients, 20 cases (37%) had secondary and 34 cases had tertiary bone grafting.

Out of the total 54 patients, 28 cases (52%) were under supervision of orthodontist (pre- and post-surgery). In general, 59% (32/54) of patients had successful alveolar bone grafting. Secondary unilateral and bilateral alveolar bone grafting had 77% and 71% success frequency, respectively. These figures were 50% for both unilateral and bilateral tertiary bone grafting.

Table 1 shows the success of alveolar cleft bone grafting according to cleft type, grafting time and orthodontic treatment. Logistic regression model (Table 2) controlling for patient's gender, grafting time (secondary or tertiary), cleft type (unilateral, bilateral) and orthodontic treatment (presence or absence) showed that presence of orthodontic treatment is associated with a higher success frequency in alveolar cleft bone grafting. (OR = 2.9, 95% CI: 1.0-10.1)

Table 1. Frequency of success (%) in alveolar cleft bone grafting (n=54) according to grafting time and cleft type.

Factors		Orthodontic Treatment	
		Presence	Absence
Grafting Time	Secondary	10 (83%)	5 (63%)
	Tertiary	10 (63%)	7 (39%)
Cleft Type	Unilateral	10 (77%)	8 (50%)
	Bilateral	10 (67%)	4 (50%)

surgery treatment especially for anterior and

Table 2. Success of alveolar cleft bone grafting at Shariati Hospital as explained by a logistic regression model.

Factors	Estimate of Strength	Standard Error	OR	Lower	Upper	P-Value
Grafting Time (Secondary, Tertiary)	-0.969	0.648	0.4	0.1	1.4	0.13
Cleft type (Unilateral, Bilateral)	-0.293	0.613	0.7	0.2	2.5	0.63
Orthodontic treatment (No, Yes)	1.077	0.633	2.9	1.0	10.1	0.05
Gender (Male, Female)	-0.055	.619	0.9	0.3	3.2	0.93

Goodness of fit by Hosmer and Lemeshow, $p=0.9$

Discussion

Successful treatment of cleft patients needs continuous and permanent care from birth to early puberty by means of orthodontic and surgical treatments.^{13,14} The orthodontic treatment of the cleft patient is recommended for both child and adult patients as regard to provide the appearance of the lip and nose, the ability to speak clearly and final appearance and function of the teeth.¹⁵ One of most important factors, probably affecting the outcome of bone grafting is the presence of physiological stress.¹⁶

The finding of this study regarding, orthodontic treatment to be the strongest factor in association with a higher grafting success, reveals the importance of a teamwork approach for the cleft patients. According to these findings, we can suggest that orthodontic supervision and follow-up has an important role in success of alveolar cleft bone grafts. Our finding agrees with that of Kindelan and Roberts-Harry in which they have shown that alveolar clefts bone grafting followed by orthodontist had higher success rate compared to those without any orthodontic care (63% vs. 40%).¹⁷ In another study, 91% of the patients having pre-surgery palatal expansion were evaluated as grade 1 and 2 (successful grafting) from four-level scaling system.¹¹

As it has been suggested, the orthodontist has a number of roles in cleft patients' treatment including recommending the timing of treatment performed based on patient's growth, and post

posterior cross-bite commonly occurring in surgically treated patients.¹⁸ This calls for more emphasis on a multi-disciplinary approach including both orthodontists and maxillofacial surgeons in alveolar cleft bone grafting in Iran in a sense that no such a surgery should be performed without orthodontics consultation.

Conclusion

Alveolar cleft bone grafting is necessary for reconstruction of the complete clefts. Cleft lip and palate treatment needs comprehensive on-time surgical and orthodontic management and all the patients must be under supervision of orthodontists to take benefit of surgical treatment. Considering to these points, proper and standard treatment of cleft lip and palate patients, needs continuous teamwork medical care from birth onward to achieve best result in occasion time.

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References

1-Rajabian MH, Sherkat M. An epidemiologic study of oral clefts in Iran: analysis of 1,669 cases. *Cleft Palate Craniofac J.* 2000;37:191-6.

- 2-Golalipour MJ, Mirfazeli A, Behnampour N. Birth prevalence of oral clefting in northern Iran. *Cleft Palate Craniofac J.* 2007;44:378-80.
- 3-Aurouze C, Moller KT, Bevis RR, Rehm K, Rudney J. The Presurgical Status of the Alveolar Cleft and Success of Secondary Bone Graft. *Cleft Palate-Craniofac J.* 2000;37:179-84.
- 4-Koberg WR. Present view on bone grafting in cleft palate (a review of the literature). *J Maxillofac Surg.* 1973;1: 185-93.
- 5-Bergland O, Semb G, Abyholm F. Elimination of the residual alveolar cleft by secondary bone grafting and subsequent orthodontic treatment. *Cleft Palate J.* 1986; 23 175-205.
- 6-Enemark H, Sindet-Pedersen S, Bundgaard M. Long-term results after secondary bone grafting of alveolar clefts. *J Oral Maxillofac Surg.* 1987;45: 913-19.
- 7-Enemark H, Krantz-Simonsen E, Schramm JE., Secondary bone grafting in unilateral cleft lip and palate patients: indications and treatment procedure, *Int J Oral Surg.* 1985;14:2-10.
- 8-Eldeeb ME, Messer LB, Lehnert MW, Hebda TW, Waite DE. Canine eruption into grafted bone in maxillary alveolar cleft defects. *Cleft Palate J.* 1982;19:9-16.
- 9-Kindelan JD, Nashed RR, Bromige MR. Radiographic assessment of secondary autogenous alveolar bone grafting in cleft lip and palate patients. *Cleft Palate Craniofac J.* 1997;34:195-8.
- 10-Lilja J, Kalaaji A, Friede H, Elander A. Combined bone grafting and delayed closure of the hard palate in patients with unilateral cleft lip and palate: Facilitation of lateral incisor eruption and evaluation of indicators for timing of the procedure. *Cleft Palate Craniofac J.* 2000;37:98-105.
- 11-Newlands LC. Secondary alveolar bone grafting in cleft lip and palate patients. *Br J Oral Maxillofac Surg.* 2000;38: 488-91.
- 12-Dempf R, Teltzrow T, Kramer FJ, Hausamen JE. Alveolar bone grafting in patients with complete clefts: A comparative study between secondary and tertiary bone grafting. *Cleft Palate Craniofac J.* 2002; 39:18-25.
- 13-Boyne PJ, Sands NR. Secondary bone grafting of residual alveolar and palatal clefts. *J Oral Surg.* 1972;30:87-92.
- 14-Steinberg B, Padwa BL, Boyne P, Kaban L. State of the art in oral and maxillofacial surgery: treatment of maxillary hypoplasia and anterior palatal and alveolar clefts. *Cleft Palate Craniofac J.* 1999;36: 283-91.
- 15-Marcovitch RC. Orthodontic approach in the treatment of the cleft patient. *Oral Maxillofacial Surg Clin N Am.* 2002;14: 463-76.
- 16-Honma K, Kobayashi T, Nakajima T, Hayasi T. Computed tomographic evaluation of bone formation after secondary bone grafting of alveolar clefts. *J Oral Maxillofac Surg.* 1999;57:1209-13.
- 17-Kindelan J, Roberts-Harry D. A 5-year post-operative review of secondary alveolar bone grafting in the Yorkshire region. *Br J Orthod.* 1999; 26:211-7.
- 18)Ricalde P, Savastano N. Management of the cleft maxilla. In: Turvey TA, Scully JR, Waite PD, Castello BJ, Ruiz RL, eds. *Oral and maxillofacial surgery. Volume III.* Second edition: WB Saunders; 2009:806-12.