

THE SIGNIFICANCE OF BONE GRAFTS IN THE OSTEOTOME SINUS ELEVATION TECHNIQUE; WHAT DOES THE LITERATURE TELL US?

Waleed Alibrahim *

ABSTRACT

Background : Osteotome sinus floor elevation (OSFE) is a technique commonly performed in the posterior maxilla. The significance of applying bone substitutes is a matter of controversy. The aim of this literature review to evaluate the influence of bone graft on the success rate of dental implants placed with the OSFE technique.

Material and methods: An electronic search was performed on Pubmed for all the articles published in English from 2000-2021 comparing the osteotome sinus elevation technique with or without bone grafting. Only clinical studies with test and control groups comparing the OSFE technique with and without bone, with at least 10 patients involved were included.

Results: 7 studies were included, the survival rate, marginal bone loss, endosinus bone gain were compared between studies.

Conclusion: The literature review showed that the OSFE technique with the incorporation of bone substitutes did not add any advantage over the technique without bone grafts.

KEY WORDS: Osteotome , maxillary sinus, dental implants, bone grafts

INTRODUCTION

Dental implants are considered the first line of treatment for the replacement of missing teeth. This is mainly due their high survival rate and patient acceptance. The success of dental implants depends to a great extent on the bone quality of the edentulous area ⁽¹⁾. The posterior maxilla is one of

the challenging sites for implant placement due to a number of factors such as the quality of the bone and the approximation of the maxillary sinus ⁽²⁾. The osteotome sinus elevation technique is a successful technique commonly performed in the posterior maxilla when the subantral bone is around 4-5 mm ⁽³⁾. The technique was first introduced by

* Consultant Restorative and Implant Dentistry, Program Director for the Implant Fellowship Program, Head of Dental Supply Department, Dental Center, Prince Sultan Military Medical City, Riyadh, Saudi Arabia

Tatum in 1986 and then modified by Summers in 1994⁽⁴⁾. Summer described the technique to be performed by a series of taper osteotomes with concave tips and a mallet where the osteotomes fracture and elevate the sinus floor increasing the available bone height. Summer advocated the use of bone grafts along with the technique to minimize the risk of membrane perforation since the bone graft will act as a hydraulic plug decreasing the forces applied on the membrane⁽⁵⁾. A number of modifications of the Summers' technique have been discussed in the literature with or without the use of bone grafts⁽⁶⁾. The addition of bone grafts in the technique adds a risk if perforation would occur leading to bone particles floating in the maxillary sinus⁽⁵⁾. The use of bone grafts in such procedure is a matter of discussion. The aim of the current review is to evaluate the significance and necessity of bone grafts with the osteotome sinus elevation technique.

MATERIALS AND METHODS

Search was done on Pubmed for all the articles published in English from 2000-2021 comparing the osteotome sinus elevation technique with or without bone grafting. The key words were: Osteotome sinus elevation, osteotome sinus elevation with or without bone grafts, Transcrestal sinus elevation. All abstracts were reviewed and only studies with the following inclusion criteria were enrolled:

- Maxillary sinus elevation was performed with the osteotome technique with simultaneous implant placement
- Clinical Studies with a control and test group comparing the osteotome technique with and without bone grafts
- The Residual bone height and type of bone graft were mentioned

- A minimum of 10 patients were included in the study
- Studies were carried out on Humans

Exclusion criteria:

- Maxillary Sinus elevation with a technique other than the osteotome technique
- Studies on cadavers and animals
- Studies involving Immediate loading

All the articles that were included were compared regarding the significance of bone grafts concerning implant survival. Additional information was also gathered regarding the type bone graft used and amount of marginal bone loss and residual bone height. No Attempts was made to identify unpublished materials or to contact the authors of the excluded articles to obtain more information or missing data. Multiple studies on the same cohort of patients with assessment at different time intervals were not excluded from the review. Only clinical trials comparing the osteotome sinus elevation technique with or without grafting were selected.

DISCUSSION

A Pubmed search revealed 257 abstracts with the keywords, 30 were downloaded and 7 were included in the study. Data from the included studies are mentioned in table 1

The review included 7 articles. To our knowledge, the studies mentioned in table 1 were the only studies directly comparing the osteotome sinus elevation technique with or without bone.

All the included studies had the same implant system used. Regarding the type of bone substitutes used, all the studies except Lai 2010 have used deproteinized bovine bone. Lai HC 2010 and Marcovic 2016 used beta tricalcium phosphate.

TABLE (1) List of included studies.

	Implant No Patient No	Residual bone height	Follow up	Implant system	Type of Bone graft	MBL (mm)		ESBG (mm)		Implant survival (%)	
						G 1	G 2	G1	G2	G 1	G 2
1	Qian SJ 2020 37 45	4.58 + 1.28	10 years	Straumann	Xenograft	1.67	1.52	3.07	3.14	90.7	95
2	Merheb J 2019 37 12	2.4 + 0.9	5 years	Straumann	Xenograft	0.7	0.6	4.8	3.8	90	94.1
3	Nedir R 2017 37 12	2.4 + 0.9	5 years	Straumann	Xenograft	0.7	0.6	4.8	3.8	90	94.1
4	Markovic A 2016 180 45	6.59 + 0.45	2 years	Straumann	B-TCP	-	-	61.4%	53.2%	100	100
					Xeno	-	-	66.3%			
					B-TCP+Xeno			33.47%			
5	Si MS 2013 41 41	4.6 + 1.31	3 years	Straumann	Xeno + Autogenous	1.33	1.38	3.17	3.07	95.2	95
6	Lai HC 2010 280 202	5.6 + 2.5 4.7 + 2.1	5 years	Straumann	B-TCP + autogenous chips	-	-	-	2.66	92.13	97.38
7	Pjetersson 2009 252 181	7.5 + 2.2	3.2 years	Straumann	Xenograft	2.67	2.67	39.1 %	77.9%	97.4	97.4

G 1: with bone graft

G 2 : without bone grafts

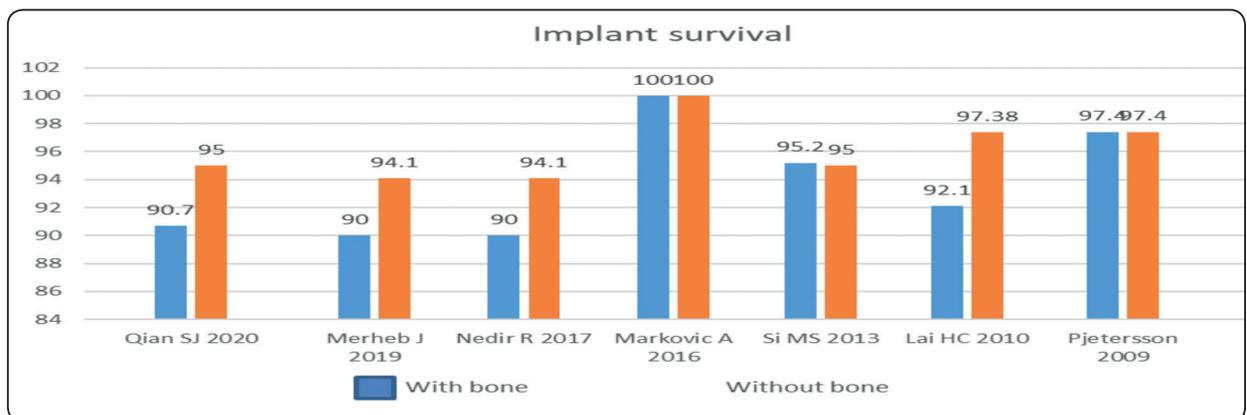


Fig. (1) Comparison of survival rate among included studies

Nedir et al ^(7,8,9) published three studies that included follow up at 1,3 and 5 years. The 5 year study was the article included in the review.

The survival rate in all the included studies (Fig.1) ranged from 90-100%, which is similar to survival rates of implants placed in any other site not approximate to the maxillary sinus. The studies by Qian et al ⁽¹⁰⁾, Merheb et al ⁽¹¹⁾ and Nedir et al ^(7,8,9) showed an increase of survival rate for implants placed with the osteotome sinus elevation technique without bone grafts although the difference was not statistically significant.

The marginal bone loss was 1.2 – 1.67 for all the included studies. The studies have shown that the addition of bone grafts did not have an influence on marginal bone loss and the amount of bone loss related to implants placed with the osteotome technique were similar to the marginal bone loss placed with the standard implant placement technique.

Regarding the Endosinus bone gain, the studies have shown more bone gain was associated with the bone graft groups but the difference was not statistically significant. Nedir et al demonstrated Pjetursson et al 2009 found that the probability of gaining more than 2 mm of endosinus bone was 39.1% when no grafting was used. The probability increased to 79.1 % when bone grafts were added.

The study by Merheb et al ⁽¹¹⁾ was the only study to our knowledge that compared the influence of grafting to implant stability. Their study demonstrated that the stability of implants placed was the same in grafted and non-grafted sites.

Lai et al ⁽¹³⁾ studied the influence of grafting on the clinical success of placing dental implants in the posterior maxilla using the osteotome sinus elevation technique. Their study included 280 implants placed in 202 patients and indicated that uneventful osseointegration may be predictable on applying osteotome sinus elevation whether with

or without grafting. The perforation rate was also addressed and compared between both groups. They found that the 5 year implant based perforation rate was 7.8% for the grafting group and 2.6 for the nongrafting group.

CONCLUSION

The use of bone grafts along the osteotome sinus elevation technique is well documented in the literature and well supported with high survival rates. None of the studies has shown that the addition of bone grafts has a role in the success rate, or the implant stability. The osteotome technique without grafting material has not been associated with any side effect or complications. The incorporation of bone grafts increases the cost of the procedure and may increase the risk of certain complications such as membrane perforation.

CONFLICT OF INTEREST

The author certifies that he has NO affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript

REFERENCES

1. Sani E, Veltri M, Cagidiaco MC, Balleri P, Ferrari M. Sinus membrane elevation in combination with placement of blasted implants: a 3-year case report of sinus augmentation without grafting material. *Int J Oral Maxillofac Surg.* 2008;37:966-9.
2. Balshi T, Wolfinger G. Management of the posterior maxilla in the compromised patient: historical, current, and future perspectives. *Periodontology 2000*, Vol 33, 2003,67-81.
3. Pjetursson B, Lang N. Sinus floor elevation utilizing the trans-alveolar approach. *Periodontology 2000*, Vol 66, 2014,59-71
4. Summers RB. A new concept in maxillary implant surgery: the osteotome technique. *Compendium (Newtown, Pa.)*. 1994 Feb;15(2):152, 154-6, 158 passim; quiz 162.

5. Rosen PS, Summers R, Mellado JR, et al. The bone-added osteotome sinus floor elevation technique: multicenter retrospective report of consecutively treated patients. *Int J Oral Maxillofac Implants*. 1999 Nov-Dec;14(6):853-858.
6. Emmerich D, Att W, Stappert C. Sinus Floor Elevation Using Osteotomes: A Systematic Review and Meta-Analysis. *J Periodontol* 2005 Aug;76(8):1237-51
7. Nedir N, Nurdin N, Khoury P et al. Osteotome sinus floor elevation with and without grafting material in the severely atrophic maxilla. A 1-year prospective randomized controlled study. *Clin Oral Impl. Res.* 00,2008,1-8.
8. Nedir N, Nurdin N, Khoury P et al. Short Implants Placed with or without Grafting in Atrophic Sinuses: The 3-Year Results of a Prospective Randomized Controlled Study. *Clinical Implant Dentistry and Related Research*, Volume 18, Number 1, 2016
9. Nedir R, Nurdin N, Abi Najm S et al. Short implants placed with or without grafting into atrophic sinuses: the 5 year results of a prospective randomized controlled study. *Clin Oral Impl. Res.* 00,2016,1-10
10. Qian S, Mo J, Qiao S et al. Long term outcomes of osteotome sinus floor elevation with or without bone grafting: The 10-year results of a randomized controlled trial. *J Clin Periodontol* 2020;00:1-10
11. Merheb J, Nurdin N, Bischof M et al. Stability evaluation of implants placed in the atrophic maxilla using osteotome sinus floor elevation with and without bone grafting: A 5-year prospective study. *Int J oral Implantology* 2019;12(3):337-346.
12. Lai H-C, Zhuang L-F, Lv X-F et al. Osteotome sinus floor elevation with or without grafting: a preliminary clinical trial. *Clin Oral Implants Res* 2010; 21: 520–6.