

Alveolar ridge expansion: comparative study of Summers' and Osseodensification techniques

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Abstract

Background: An adequate volume of bone in the implant bed is essential to ensure osseointegration and long term implant stability. There are different techniques currently available in order to achieve a adequate bone volume to place implants. One of the most widely used techniques for the posterior maxilla alveolar ridge expansion is the Summers's technique, whereas osseodensification is another contemporary method also being proposed, which is non-subtractive in nature and aims to enhance primary stability.

Aim: The aim of this study was to compare the Summers's technique with the osseodensification technique recommended by Densah® Bur for alveolar ridge expansion in the the posterior maxillary region.

Material and Methods: A total of 10 implants at the posterior maxilla region were evaluated in three patients. Five implants were placed by using Summers's technique and five by using the osseodensification one (Densah® Bur). In each patient at least two implants were placed. The implants were placed on opposite sides in which one of the techniques was performed. The alveolar ridge expansion was measured by using a caliper before placement of the implants, immediately after their insertion and after 6 months when the implant reopening was performed. Primary stability was also analysed in ISQ (OSSTELL), immediately after the implant placement and in the implant reopening. Thus, these parameters allowed to evaluate which technique promotes greater alveolar ridge expansion and greater primary stability.

Results: There were no statistical difference between the two techniques regarding to the measurement of alveolar ridge expansion in the preoperative, postoperative and reopening periods. As for the primary stability, no statistical difference was observed in the postoperative period and after six months when the implants were reopened.

Conclusion: According to the results, there was no difference between the two techniques regarding to the measures of alveolar ridge expansion and primary stability.

Methods and Materials

A total of 10 implants were placed in the posterior region of maxilla in female patients (Table 1). Two patients were fully edentulous and one of the them was partial edentulous, with at least 2 implants being placed in each patient. They were placed on opposite sides and one of the techniques was performed on each side. Under local anaesthesia, a mucoperiosteal incision on the crest was made. This was followed by elevation of the flap and then the alveolar bone thickness was measured with a surgical caliper (Figure 1A). Then, the implants were placed in one of the sides by using the osseodensification technique with the DENSAH® Bur kit according to the manufacturer's instructions (Figures 1B-D). In the opposite side, the Summers' technique was performed with osteotomies (Figure 1E). At the end of each technique the implants were placed (Sin implants, Grip Hard Porous - 4.0 x 10 mm) and at the same time the ISQ primary stability (OSSTELL) was individually measured. Standard suture technique with polyglactin resorbable suture was utilized for wound closure and postsurgical medications were also administered. After six months, a new CT scan was requested and a new measurement was performed with surgical caliper for comparison with the initial measurement. A new evaluation of the initial stability of the ISQ (OSSTELL) implant at the time of reopening was also performed. Data were tabulated in a standardized database at each stage performed and the Shapiro-Wilk's test was applied to assess the data normality. The significance level was set at $p < 0.05$. The bone thickness difference (mm) in the preoperative, immediate postoperative and 6-month postoperative periods were assessed by using Tukey's test ($p < 0.05$). Paired Student's t-test was used to assess the primary stability of the implant at the time of its placement and after 6 months of surgery with Summers technique. The Wilcoxon's test was used to assess the difference between primary implant stability at the time of the placement and after 6 months of the surgery with the Densah® technique. The difference in the increase in horizontal thickness between Summers' and Densah® techniques was evaluated by using Student's t-test, whereas the difference between both techniques regarding loss of primary implant stability was assessed by using Mann-Whitney's test.

Patient	Gender	Implant site
I	Female	16, 17, 25, 27
II	Female	15, 24
III	Female	16, 17, 25, 27

Table 1: number of patients, gender and implant site placement.

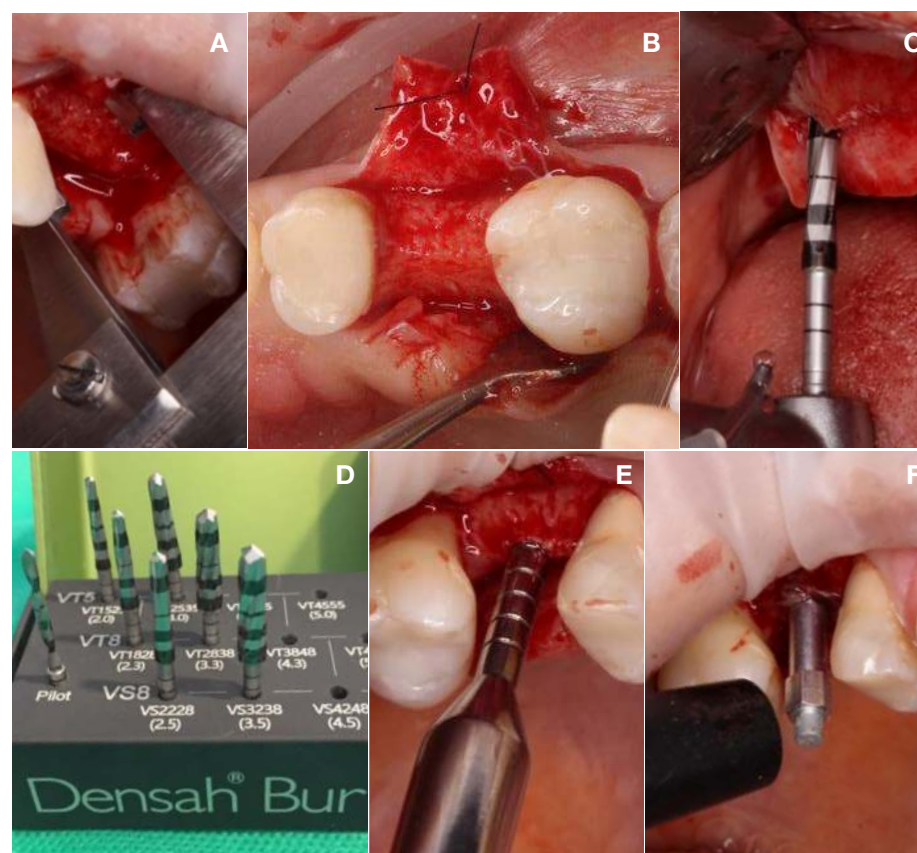
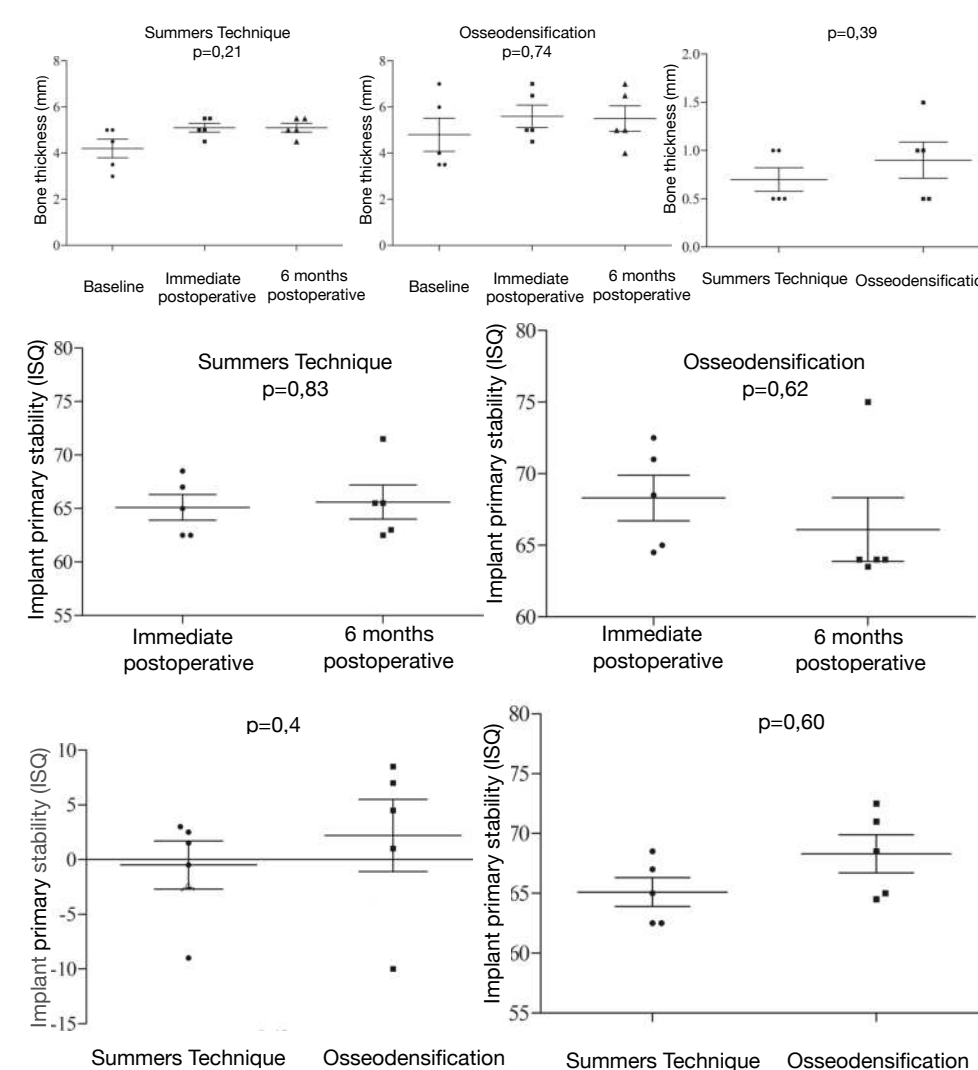


Figure 1: A: measurement of the alveolar bone thickness with a surgical caliper, B: initial alveolar bone thickness, C: osseodensification technique, D: DENSAH® Bur kit, E: Summers technique, F: OSSTELL.

Results

Region	Baseline bone thickness (mm)	Bone thickness after implant placement (mm)	Bone thickness after reopening (mm)	Implant primary stability after placement (ISQ) - VIL	Implant primary stability after reopening (ISQ) - VIL	Baseline CBCT bone thickness (mm)	Region	Baseline bone thickness (mm)	Bone thickness after implant placement (mm)	Bone thickness after reopening (mm)	Implant primary stability after placement (ISQ) - VIL	Implant primary stability after reopening (ISQ) - VIL	Baseline CBCT bone thickness (mm)
25	3	5	5	67/67	65/66	2,95	17	4	5	5	71/74	67/61	5,34
17	4,5	5	5	70/67	66/65	4,72	16	3,5	4,5	4	71/71	67/61	5,44
25	5	5,5	5,5	67/63	72/71	3,86	24	6	6,5	6,5	67/63	75/75	5,32
25	3,5	4,5	4,5	62/63	62/64	3,57	17	7,0	7,0	7,0	64/65	63/64	7,94
27	5	5,5	5,5	63/67	62/63	5,24	16	3,5	5	5	67/70	65/63	5,72
Mean (EP)	4,2 (±0,4)	5,1 (±0,2)	5,1 (±0,2)	65,1 (±1,2)	65,6 (±1,6)	4,1 (±0,5)	Média (EP)	4,8 (±0,7)	5,6 (±0,5)	5,5 (±0,5)	68,3 (±1,6)	66,1 (±2,2)	5,9 (±0,5)



Conclusion

According to these results, there were no differences between the techniques regarding the gain of bone thickness volume in the immediate postoperative period and on implant reopening periods. As for the primary stability, no statistically significant difference was observed between the techniques in the immediate postoperative period and on implant reopening periods.

References

- Summers RB. Sinus floor elevation with osteotomes. *J Esthet Dent* 1998;10:164-171.
- Tetsch J, Tetsch P, Lysek DA. Long-term results after lateral and osteotome technique sinus floor elevation: a retrospective analysis of 2190 implants over a time period of 15 years. *Clinical oral implants research*. 2010;21(5):497-503.
- Trisi P, Berardini M, Falco A, Podaliri Vulpiani M. New Osseodensification Implant Site Preparation Method to Increase Bone Density in Low-Density Bone: In Vivo Evaluation in Sheep. *Implant Dent*. 2016;25(1):24-31.
- Lopez CD, Alifrag AM, Torroni A, Tovar N, Diaz-Siso JR, Wittek L, et al. Osseodensification for enhancement of spinal surgical hardware fixation. *J Mech Behav Biomed Mater*. 2017;69:275-281.
- Tian JH, Neiva R, Coelho PG, Wittek L, Tovar NM, Lo IC, et al. Alveolar Ridge Expansion: Comparison of Osseodensification and Conventional Osteotome Techniques. *J Craniofac Surg*. 2019;30(2):607-610.