CLINICAL OUTCOMES AFTER RIDGE PRESERVATION WITH TWO XENOGRAFTS: A 4-YEAR RANDOMIZED CLINICAL TRIAL

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Abstract

After tooth extraction the alveolar ridge undergoes horizontal and vertical resorption that may lead to an unaesthetic outcome. This is why several techniques have been proposed for ridge preservation after tooth extraction. One of the most accepted is the placement of a bone graft. Aim of this study was to evaluate and compare at 4 years follow-up clinical and esthetic outcome of single-implant restorations placed after socket preservation grafted with cortical porcine bone vs collagenated cortico-cancellous porcine bone and spontaneously healed sockets. Thirty-four patients in the present randomized controlled clinical trial underwent single-tooth extraction in the premolar/molar areas. 10 sites were grafted with collagenated cortico-cancellous porcine bone(*coll*), 10 sites with cortical (*cort*) porcine bone and 14 sites underwent natural healing(*control*). Four months after tooth extraction and ridge preservation implants were placed. Prosthetic restorations were delivered after a 4-month period of healing. Clinical and aesthetical parameters were evaluated for a follow-up period of 4 years. Both test groups showed better outcome in terms of facial soft tissue level, papilla index and marginal bone resorption than the control group. Favorable esthetic outcome and stability of soft/hard tissue around single implant crowns can be expected in patients with ridges preserved either with cortical or collagenated cortico-cancellous porcine bone.

Background and Aim

After tooth extraction the alveolar ridge undergoes both horizontal and vertical resorption. Several studies reported that horizontal bone resorption is about 63% while the vertical bone resorption is about 22%¹. Taking in analysis soft tissue volume highly increases the rate of both horizontal and vertical resorption^{2,3}. These physiological events may influence the future outcome of the implant treatment, leading to an unsatisfactory aesthetic result. This is why several techniques have been proposed for ridge preservation after tooth extraction⁴. Studies attested that tissue changes after tooth extraction could be reduced by grafting the socket with biomaterials⁵. Extraction sockets grafted with xenograft materials have shown significant reduction of ridge changes compared with sockets that had spontaneous healing^{6,7}. However, the amount of ridge modifications after socket grafting have shown different results, which can be related to the type of biomaterial used and the residual buccal bone thickness⁸. Many studies demonstrated that cortical or cancellous bone substitutes have different healing patterns. For these reasons a proper knowledge over the biomaterials used for socket preservation seems to be fundamental, in order to guarantee to the patient the best aesthetic outcome of the implant therapy.

Methods and Materials

- ✓ 34 patients were enrolled in the present randomized controlled clinical trial and underwent single-tooth extraction in the premolar/molar areas.
- ✓ 10 sites (*coll*) were grafted with **collagenated cortico-cancellous porcine bone** (MP3, OsteoBiol®, Tecnoss®, Coazze, Italy)
- ✓ 10 sites (*cort*) with **cortical porcine bone** (APATOS, OsteoBiol®, Tecnoss®, Coazze, Italy)
- ✓ 14 sites underwent **natural healing** (*control*)
- ✓ 4 months after tooth extraction and ridge preservation implants were placed. Prosthetic restorations were delivered after a 4-month period of healing.
- ✓ Clinical and radiological measurements were registered at 1 Year and 4 Years after prosthetic delivery.

The outcome variables used for the follow-up were:
Peri-implant marginal bone level (MBL) was set as the distance between the reference point and the most apical point of the MBL. The reference point was the fixture–abutment interface. evaluated on intraoral radiographs at the mesial (m) and distal (d) sites (mMBLx and dMBLx, in which X = 0, 1, 2, and 3 for times T₀, T₁, T₂, and T₃, respectively)
Facial soft tissue level (FSTL) was evaluated by measuring the distance between the level of soft tissue at the mid-facial gingival level and a reference line, which connected the FSTL of the adjacent teeth.
Papilla Index (PI) was evaluated in accordance to Jemt classification⁹, giving a value to the two papillary scores (mesial and distal): absence of papilla (score 0), less than half of the height of the papilla (score 1), at least half of the height of the papilla (score 2), the papilla fills up the entire space (score 3), the papilla is hyperplastic (score 4). An average between the 2 scores (mesial and distal) was done for each tooth

All analyses were collected and measured by an independent and well experienced observer. Together with descriptive statistics, for each of the outcome variables, pairwise comparisons were performed using the Wilcoxon signed-rank test for matched samples. The level of statistical significance was set at 0.01 for all analyses.

Results

variables	groups						statistics (P-value)					
	collagenated (col)		cortical (cor)		control (con)		1yr		4yrs			
time	1yr	4yrs	1yr	4yrs	1yr	4yrs	col vs cor	col vs con	cor vs con	col vs cor	col vs con	cor vs con
ΔMBL (mm)	-0.54±0.46	-0.96±0.54	-0.29±0.40	-0.71±0.40	-0.78±0.52	-1.71±0.51	0.16311	0.19775	0.01343	0.18525	0.00086	0.00001
ΔFSTL (mm)	0.36±0.63	0.43±0.78	-0.08±0.51	0.00±0.60	-0.92±0.67	-1.38±0.99	0.06634	0.00002	0.00170	0.15586	0.00001	0.00032
PI	1.25(1.25)	2.75(0.88)	1.5(0.5)	3.0(0.13)	2.0(0.5)	1.25(1.66)	0.84169	0.00427	0.00060	0.07246	0.00395	0.00074

Conclusions

Several studies has demonstrated a notable volume reduction after tooth extraction¹. These changes could compromise the aesthetic outcome of final restoration, either with an implant-supported restoration or a traditional tooth-supported restoration. Although different techniques have been proposed for maintaining the original alveolar ridge dimensions, a complete preservation seems to be a non-achievable outcome¹⁰. Previous studies from Barone et al. demonstrated that the marginal bone level around implants placed in grafted sockets and in naturally healed sockets have similar clinical performances¹¹, in this study the marginal bone level around implants placed in sockets grafted either with *Coll* or *Cort* seemed to be more stable than the *no-grafted* group. The long term stability of soft tissues (in terms of FSTL and PI) is crucial for a positive aesthetic outcome. Outcomes from this study showed that facial soft tissue level remained stable at both 1 year and 4 years evaluation in the *coll* and *cort* group, conversely *control* group had some buccal recession. Maintenance of papillae height and appearance is crucial for a successful outcome of a prosthetic restoration. In both grafted group a satisfying regrowth of the papillae was achieved at 4 years evaluation, with a statistically significant difference compared to control group. This result might be related to the better sustenance of soft tissues by peri-implant hard tissue, that showed lower degree of bone resorption.

Within the limitations of this study, it can be concluded that more favorable esthetic outcome and stability of soft/hard tissue around single implant crowns can be expected in patients with ridges preserved either with cortical or collagenated cortico-cancellous porcine bone compared to spontaneous healing sockets, there was no significant difference between the 2 grafted groups.

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