Crestal bone remodeling at implants

With different configurations placed at different depth into extraction sockets. Experimental study in dogs.

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Introduction

Major remodeling of the alveolar bone occurs following tooth extraction (Schropp et al. 2004; Araújo & Lindhe 2005). The height of the buccal wall decreases, and bone level discrepancies (Schropp et al. 2001; Araújo & Lindhe 2005; Car- darfelo et al. 2003; Botticelli et al. 2004a). Immediate post-extraction implant placement has been proposed to preserve the dimensions of the alveolar ridge, reducing the number of surgical and clinical procedures (Calvo-Guirado et al. 2010; 2014b; Negrít et al. 2012a, 2012b) and surgical trauma (Arikian et al. 2009; Hoorn et al. 2008).

Materials and methods

The study comprised of 6 American foxhound dogs of approximately 1 year of age, each weighing 14–15 kg. The Ethics Committee for Animal Research approved the study protocol which followed the guidelines established by the European Union Council Directive86/609/EEC of February 2013/53/CEE.

- Surgical procedure
- Mandibular premolars and 1st molars (P1, P2, P3, P4) were bilaterally extracted. Multifurcated teeth were sectioned in a buccal direction at the bifurcation, the roots could be individually extracted, without damaging the remaining bone bulbs. Minimal full-thickness mucoperiosteal flaps were incised, and implants were placed. In each animal, eight implants were randomly placed, four in each hemi-mandible.
- All 16 implants (4M® Implant Technologies,Carousel, Israel) were 3.5 diameter and 10 mm length (had the same titanium grade V composition (Ti-6Al-4V alloy) and surface treatment (sandblasting and acid-etching).
- Three groups of 16 implants each were established: Group A (Lance®) with triple-thread and external hex connection; Group B (Seven®) with two spiral channels, microgrooves on the collar, and internal hex; Group C (C1®) with dual microthreads, microgrooves on the collar, and internal connection.
- Applying the same type of randomization, half of the implants in each group (in a X2) were placed with the top of the rough surface flush with the buccal bone (control) and the other half 2 mm subgingivally (test). Subsequently, healing abutments were utilized to allow non-submerged healing protocol, and digital radiographs were taken.

Discussion

The present investigation revealed greater crestal bone loss at the buccal crest than at the lingual one; this fact, corroborates findings previously reported (Araújo & Lindhe 2005; Araújo et al. 2005; Calvo-Guirado et al. 2006; 2009d, 2009e, 2010b; Hoorn et al. 2008) of non-submerged (Porcelini et al. 1999; Botticelli et al. 2005; Jing et al. 2005) rough-surface implants placed immediately after tooth extraction without regenerative techniques are in agreement with this.

The findings from the present study confirm that dimensional changes occur at the alveolar ridge following an implant placement in fresh extraction sockets (premolar and molar sites) regardless of the application of regenerative procedures. The marginal peri-implant adaptation at the time of implant placement were completely filled after 12 weeks in all groups with en ovo bone formation. Distance from the implant shoulder to the buccal and lingual bone crests was the lowest for the subcrestal group C. A certain degree of bone resorption was evident at the buccal bone wall mainly in the control group (Araújo 2010) (Figure 7). The smallest degree of crestal bone resorption was observed in the C-C site, subcrestal group.

Conclusions

The objectives of this research was to compare the bone response, as measured by the distance between the implant platform to the buccal and lingual bone crest and BIC around implants with different external macrodesigns placed either crestally or subcrestally in the dog model.

References

- Table 4 - shows mean and median linear measurements where all implant types were combined in each group. Distance between the implant shoulder to the buccal and lingual bone crests was larger in the control group; however, only the first reached statistical significance.
- Table 5 - presents BIC percentage values in all subgroups within the two groups. Values were statistically higher in all test subgroups compared with the control group in the control.
- Within each group, a subgroup showed the highest value, and differences were statistically significant.
- Table 6 - presents mean and median measurements of BIC (bone-implant contact) percentage for both groups where all implant types were combined.
- Values were statistically significantly larger in all test subgroups compared with the control group in the control.
- *Differences between values achieving statistical significance.)

Statistical analysis
- Histomorphometric parameters were analyzed using descriptive methods (SPSS 20.0; SPSS for Mac, Chicago, IL, USA). Values presented as mean ± standard deviation and median. Correlations between subgroups were analyzed through nonparametric Friedman test for related samples. For all performed tests, the significance level was set at 5%