Comparison of titanium and Roxolid implants at three different time points in an animal model

Titanium dental implants with a narrow diameter may help to overcome some limitations of regular diameter implants (e.g. cases of narrow ridge width or situations with small interdental space).

However, reducing the diameter of titanium dental implants might lead to increased clinical risks related to a lower mechanical resistance.1–3

In order to overcome this issue, Straumann developed the Roxolid alloy, which is composed of titanium and zirconium. Mechanical tests have demonstrated higher tensile and fatigue strength of the Roxolid material compared with pure titanium.1–3

In addition, preclinical data has indicated a similar or even stronger osseointegration of Roxolid compared with pure titanium.4–6 The aim of this study was to determine whether Roxolid implants exhibit similar tissue integration in comparison with pure titanium implants.

Materials and methods

In nine large bound dogs, 54 Straumann Bone Level titanium implants (control) and 54 Straumann Bone Level Roxolid implants (test) were placed. All implants had an endosteal diameter of 3.5 mm and featured the SLActive surface.

Tooth extraction surgery was performed four months prior to the implant placement surgery. The implants were placed in a randomised manner in all dogs. In every mandible, 12 implants (six per hemi-mandible) were placed by alternating the two implant types (Fig. 1).

Standardised X-rays were taken at surgery (n = 9) and after two weeks (n = 9), four weeks (n = 6) and eight weeks (n = 5) to measure the bone loss. At each stage, three animals were sacrificed for histological preparation.

The parameters measured within the histo-morphometric analysis were the first bone-to-implant contact (fBIC) and the bone-to-implant contact (BIC) in order to evaluate the osseointegration behaviour of the two groups.

The fBIC is the distance between the implant shoulder and the first bone-to-implant contact. A negative fBIC value indicates that the bone is located coronally and a positive fBIC indicates that the bone is apical to the implant shoulder. The BIC is calculated by measuring the distance between the bone crest and the apical end of the cylindrical part of the implant.

Results

Radiological analysis

Regardingcrestal bone change there was no statistically significant difference at any time point between the two materials. An initial slight bone loss at two weeks was followed by bone gain at four weeks, and at eight weeks bone was nearly at initial placement level (Fig. 1). This pattern might be attributed to the bone remodeling process.

Histo-morphometric analysis

Similar BIC values of approximately 80 % were observed for both implant types at two weeks, with peak values obtained at four weeks (Ti) and eight weeks (Roxolid), as shown in (Fig. 4). The results did not reveal any statistically significant difference in the BIC in the two materials.

The mean fBIC values did not reveal any statistically significant difference for the two implants at any evaluated time point. There was a pattern of increasing bone growth at the implant shoulder over time (Fig. 1).

Conclusions

This animal study did not reveal any statistically significant difference in osseointegration between Straumann BL Roxolid implants and Straumann BL titanium implants. From baseline to eight weeks only minimal change in bone level occurred. Mean BIC values of over 80 % were reached at four weeks and eight weeks, indicating a good anchorage of the implant. Roxolid implants showed similar osseointegration behaviour to SLActive titanium implants and have higher tensile strength than pure titanium.

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