Abstract

Introduction

This paper reports the results of a prospective case study on a new surgical technique, known as Root-T-Belt and aimed at preserving peri-implant bone crest in humans.

Case study

Seven patients with an average age of 50 (70 ± 35) were selected. Ten implants were inserted (Seven-M.I.S. Technologies, Israel), using the Root-T-Belt surgical technique. The implants were loaded in 90 days. Marginal bone loss 6 months after x-ray analysis: mesial area, 0.8; distal area, 0.7.

Accumulative implant integration success rate of 100% during the first six months of use. Crest bone loss around the implants was between 1.3 ±0.2 mm, i.e. 0.7 mm on average 6 months into the study.

Conclusion

The results of the study suggest that this is a very simple technique which reduces treatment time, stabilizes the bundle bone around the implants and creates a biological surface offering long-term predictability.

Introduction

The Root-T-Belt method is a modification of the technique created by Dr. Markus Hurtzeler, which appeared in the Journal of Periodontology in 2000. In Dr. Hurtzeler's "Shield Technique," a portion of the palatal root is extracted via a mesial-distal tooth sectioning, preserving the vestibular root remainder, so as to prevent bundle bone resorption. The former technique is also a derivation of Drs Fabrice Cherel and Daniel Etienne's method, recently published in the Journal of Periodontology. Their sectioning is, however, vestibular-lingual, thus preserving the proximal remainder of the root to protect the papilla. 7,8,9,10,11,12,13,14,15,16,17,18,19,20,21

We believe that our technique is simpler to execute and more predictable, since the implant is surrounded by root remainder (periodontium, cement and dentin), creating a belt-like structure that prevents any displacement and preserves the peri-implant/bone structure system over time.

We load the implants in the aesthetic zone in approximately 90 days, therefore skipping 2 to 3 surgical stages of guided bone regeneration and preserving all 360° of bone crest.

Our results are extremely encouraging and vitally important for bone preservation and, consequently, for aesthetics in the lower and upper incisor and canine teeth area. Two facts favouring preservation are: a) tooth extraction is highly complex—extraction of canines in particular, given that these are the longest dental pieces; b) bone anchorage on incisors and canines is very strong.

The aim of this case study is to create a new surgical technique for dental implants. The technique involves implant placement using root remainders in the aesthetic zone, in order to preserve all 360° of bone structure.

It is based on the literature of the 1980s, in which several authors state that, if the remaining part of a tooth's root is in perfect condition, it can be gingivally submerged and thus preserve the bone structure. 2,3,4 Also important for this method is the fact that the alveolar ridge undergoes dynamic biological changes after extraction, namely a decrease in its internal bone tissue. 5,6

Case Study

The study involved 4 upper incisors, 3 upper canines and 3 lower canines.

Ten M.I.S. Seven implants (M.I.S. Technologies, Israel) were used—five 13 mm and five 16 mm implants. All ten implants had a 3.75 mm diameter. (Table 1)

Inclusion Criteria

Patients were selected based on the following criteria:
1) Dental implant rehabilitation being the treatment of choice
2) Physically able to tolerate conventional surgical and restoration procedures
3) Signing of an informed consent form
4) Implant insertion torque > 32 N cm with good primary stability
5) Dense to normal bone quality, bone quality being established based on the categories set either by Trisi & Rao, or by Lekholm & Zarb, i.e. Type I (dense), Type II (normal), Type III (soft) 8,10
6) Presence of devital or vital teeth with aseptic, horizontal or oblique root fractures

Exclusion Criteria

1) Systemic disease, such as diabetes (of any kind, regardless of whether or not kept in check).
2) Therapeutic head radiation treatment for the previous 12 months.
3) Prospective implant location with areas not requiring bone volume increase.
4) Severe bruxism.
5) Pregnancy.
6) Smoking more than 10 cigarettes a day.
7) Having received alendronate treatment the previous year.
8) Active infection in the teeth to be treated.

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All authors abide by the Association for Medical Ethics (AME) ethical rules of disclosure.
9) Vertical root fractures with displacement in the teeth of the surgical area.

Success Criteria
Success criteria applied to each implant:
1) Clinically detectable implant immobility
2) Absence of peri-implant radiolucency on periapical x-rays
3) Absence of peri-implant infection
4) No pain, neuropathy, or paresthesia in the treated area
5) Crest bone loss of no more than 1.5 mm during the first year of functional occlusal load, and no greater than 0.2 mm per year the following years, according to the categories established by Albrektsson & Col in 1986

Study Overview and General Clinical Considerations
Patients were first administered antibiotics: 500 mg amoxicillin three times a day (500 mg AMIXEN™, Bernabó, Argentina). Analgesics: 100 mg flurbiprofen twice a day (100 mg Clinadol Forte™, Gador, Argentina) and mouth rinse with 0.12% chlorhexidine gluconate twice or three times a day after surgery (Plac-Out™, Bernabó, Argentina, or Bucogel™, Gador, Argentina).
The surgical procedure took place under local anesthetics, namely 4% carticaine (Totalcaína Forte™, Bernabó, Argentina).

Root-T-Belt Technique
Surgical areas were selected based on the presence of teeth with aseptic, horizontal or oblique root fractures—never vertical—with displacement.
For this method, if the remainder of the root has undergone endodontic treatment, it is best to remove any filling before surgery to avoid getting gutta-percha and cement into the osseointegration area via the apex, thus contaminating the implant’s primary stability area. (Figure 1, Figure 2, Figure 3 and Figure 4)
The surgical area was anesthetized and an incision made at the centre of the bone crest, from the mesial to the distal area of the remainder of the root—compensatory incisions must be avoided whenever possible.
Next, the root was worn down by means of a round pumice handpiece, creating a concave shape, positioning it apically, 2 to 3 mm from the bone crest all around. Afterwards, a Lindelman zirconium bur (M.I.S.) was inserted at the centre of the root canal without

Table 1: Implant Characteristics.

<table>
<thead>
<tr>
<th>Tooth</th>
<th>13 mm</th>
<th>16 mm</th>
<th>3.3 mm</th>
<th>3.75 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary Incisors</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxillary Canines</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandible Canines</td>
<td>3</td>
<td>3</td>
<td></td>
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</tr>
</tbody>
</table>

Figure 1: Root preparation.
Figure 2: Root preparation.
Figure 3: Implant site preparation.
Figure 4: M.I.S Zirconia fresa.
Figure 5: Impression.
Figure 6: Patient at 70 years of age with Incisors trauma.
Figure 7: Patient at 70 years of age with Incisors trauma. Cone beams and clinical aspects 30 days after.
passing the apex, so as to make sufficient space for the 2 mm zirconium spearhead bur (M.I.S.), which then went past the apex until the appropriate depth was reached. The procedure was repeated with a 3 mm zirconium spearhead bur before taking up the disposable, high-speed steel bur that M.I.S had designed for these implants: 3.3 or 3.75 mm according to the selected implant.

The implant was then installed at low speed (32 Ncm) to promote primary stability. Since this technique requires delicacy, please take into account the following when placing an implant:

**Length**
The implant must be placed at least 7 to 10 mm apically to the tooth’s apex: more than 20 years of literature on the matter has demonstrated that that is the minimum length for predictable osseointegration.

Accordingly, the usual length is between 13 and 16 mm, going past the 5 mm (minimum), 7 mm (intermediate) and 10 mm (ideal) apex, depending on the state of the remaining bone structure.

**Diameter**
It depends on the remainder of root in the treatment area. There must be sufficient friction so as to anchor it mechanically 3 or 4 mm into the root without causing the root to fracture. More frequent diameters: 3.3 mm or 3.75 mm, also according to the remaining root.

**Implant Platform Location**
3D, gingival-occlusal, mesial-distal and buccal-lingual positioning must fall within conventional parameters to offer an accurate emergency profile.

Final platform insertion is to be 2 mm subcrestal, as indicated by Calvo Guirado et al., Negri et al. and Sacristán et al. 12,13,14,15,16,17,18,19,20

The entire perimeter of the implant, with regard to its platform, must touch the root surface 2 or 3 mm high subcrestally to preserve the bone papillae. This should result in a biological space, stable peri-implant tissue and good soft tissue keratinization. The second surgical stage (opening) is to take place 90 days afterwards, normally using the Punch technique for soft tissue preservation.

**Prosthetic Procedure**
This procedure is to take place after the opening stage and the Ostell Mentor radiofrequency analysis (Gothenburg, Sweden), with an ISQ of 67 ± 54 (60 on average). It is necessary to wait 40 days for the peri-implant tissue surrounding the dental ring to stabilize, creating a stable biological space. An impression must then be taken using open tray copings. For adjustment purposes, a radiographic examination is also required. (Figure 5)

Different types of final restoration may be best suited for different cases, there being a choice between screw-retained...
crowns, cement-retained crowns attached to drillable or custom-made abutments, individual ones with ferules or bridgework, etc., so that the prosthetic design may vary from one case to the next.

**Follow-Up Procedure**

The patients were given no special diet. For the first six months, they followed a strict dentist visit schedule:
1. Every week during the first month
2. Every month from the second to the sixth month
3. Periapical x-rays for control purposes were taken at day 30, 60, 90, 120, 150 and 180

Up to the aforementioned date, the success rate was 100%, the bone loss rate was lower than usual and the preservation rate of the peri-implant soft tissue all around was excellent. (Figure 6, Figure 7, Figure 8, Figure 9, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, Figure 15, Figure 16, Figure 17, Figure 18, Figure 19, Figure 20, Figure 21, Figure 22, Figure 23, Figure 24 and Figure 25)

**Discussion**

The specific objective of this investigation was to conserve the entire root shield in the extraction socket in protecting the bundle bone area before immediate implant placement.

In this study, no histomorphometric measurements were performed but neither the crestal nor the more apical bone showed signs of resorption due to the root belt.

Several studies have shown that implant placement in fresh extraction sockets does not counteract postextractive tissue alterations like it was expected described by Araujo and Lindhe.

Baumer et al. described the reaction of the tissues in humans, a long-term clinical study and a human histological dissection were needed. Within the limitations of an animal pilot study, they concluded that the applied modification may offer a feasible treatment option to proceed the socket-shield technique in vertically fractured teeth. Cerel et al. indicated the feasibility of the interproximal shield technique. In this protocol the apex and the pulp were...
removed to minimize the risk of complication.20

The possibility of soft and hard tissue contamination during surgery, persistence of contaminants that were not seen clinically, dimension of the lesion, and a non-effective debridement of the site during the surgery are critical factors that can explain implant failure. Small gaps between the implant surface and the socket walls have the potential for spontaneous healing.21 Larger gaps may be filled with bone substitutes, which can be susceptible to contamination and infection. Immediate impressions after implantation may increase the risk of infection, but they are not reported.22,23

Recently in implant-supported prostheses, submerged roots have maintained their natural attachment apparatus at the pontic site. Roots were maintained after resection and submerged with a coronally advanced mucosal flap. The alveolar bone frame was then completely preserved.24

This approach is consistent with a study showing that the level of the papilla can be maintained by the proximal periodontium,25 and confirms the possibility of maintaining a submerged root for an indefinite period.

Buccal root fragment retention can be an option that allows a preservation of facial tissues. Histologic evaluation on dogs found newly formed acellular extrinsic fibres with inserting periodontal ligament present along the entire inner wall of the retained root fragment. Natural protection seems to be complete and the absence of inflammatory reaction may be a determinant factor in the stability of the fragment. However, buccal root retention fragment does not compensate the papillae retraction following multiple adjacent tooth extraction, whereas it may be obtained with proximal root retention fragments.

Figure 24: Clinical and R.V.G aspects 6 months later.

Conclusion

The findings of this case study indicate that the surgical technique known as Root-T-Belt, which aims at preserving all 360° of dental structure, makes the preservation of peri-implant gingival and bone structure considerably more predictable at six months from commencement.

Consent

Written informed consent was obtained from all patients for publication of this series study and accompanying images. A copy of the written consents is available for review by the Editor-in-Chief of this journal.

References

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Figure 25: Clinical and R.V.G aspects 6 months later.


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Competing interests: None declared.
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