

The socket shield technique: a conservative approach in implant dentistry

Domingos Mamede and **Filipe Amante** present a case study where the socket shield technique (SST) was used to replace an upper right central incisor using a dental implant

The number of teeth replaced by dental implants has rocketed in the last few decades, and implant dentistry has increasingly become a valid treatment option to face edentulism for a multiple range of patients. The ongoing research and the advances in the field of oral rehabilitation have provided the modern dentist with an increasing array of tools and techniques that aim to replace missing or hopeless teeth in the most conservative and aesthetic way possible, in an optimistic

attempt to replace what nature has gifted us with so exceptionally (biomimetics).

The peri-implant complex plays a quintessential role in the short- to long-term stability of implant restorations, and years of experience and clinical data have shown that respecting and preserving this delicate and crucial area, proves to be essential to achieve long-term success and predictability.

It is widely known that, following an extraction of a tooth, there is a reorganisation of the periodontal area affecting hard and soft tissue volume and irrigation. Numerous publications have verified that following tooth extraction there is a dimensional change that takes place on the alveolar ridge contour

(Amler et al, 1960; Schropp et al, 2003; Araújo and Lindhe, 2005; Fickl et al, 2008b) and, particularly, in the anterior zone, the successive soft and hard tissue deficiencies can interfere with optimal implant positioning and hamper the overall aesthetic outcome of implant-supported prosthesis (Hurzeler et al, 2010).

The immediate placement of dental implants following dental extraction and GBR techniques have been used for many years but, despite all the research in bone augmentation and periodontal surgery, there is still an element of unpredictability when the entire tooth element is removed.

Several approaches have been used and described in the literature to try and

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Aims and objectives

To present a case study where the socket shield technique (SST) was used to replace an upper right central incisor using a dental implant.

Clear expected outcomes

Correctly answering the questions on page 64 will demonstrate that the reader understands that the results presently available suggest that the SST could be considered as a credible treatment option in implant dentistry.



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Filipe Amante is licensed in medical dentistry in Porto, Portugal. A master in implantology and oral rehabilitation, he has undertaken postgraduate training in Brazil, UK and Italy, and is an Invisalign provider.

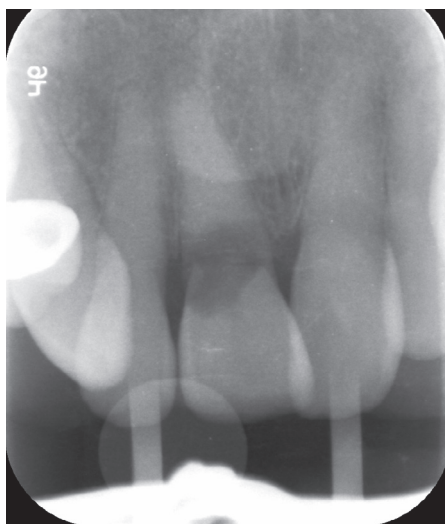


Figure 1: Preoperative periapical X-ray



Figure 2: Post decoronation



Figure 3: Hemisection of root



Figure 4: Removed palatal fragment



Figure 5: Socket with socket shield in situ

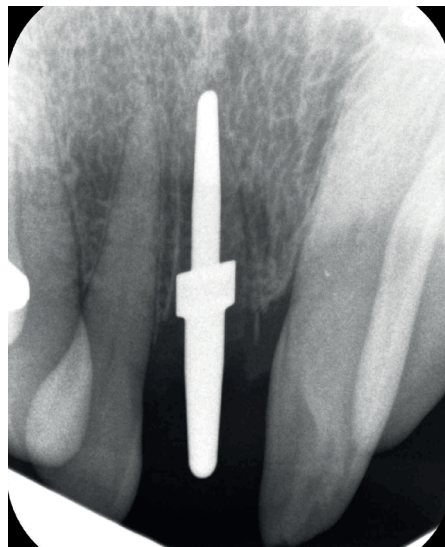


Figure 6: Periapical X-ray with parallel pin in situ

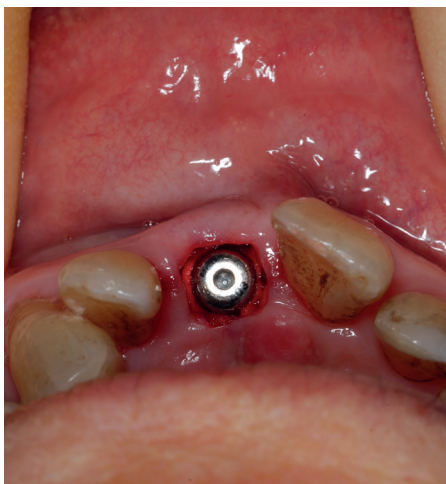


Figure 7: Implant placed with healing collar

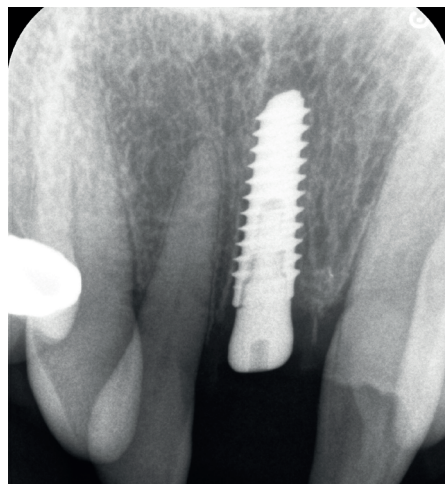


Figure 8: Periapical X-ray post implant placement

address this, including soft and hard tissue augmentation procedures, immediate provisionalisation, flapless implant placement, a more palatal orientation of the implant and possibly the use of platform switching (Baumer et al, 2017).

Despite the positive effects of these techniques, it is widely accepted that an optimal aesthetic result can only be reached in specific cases (Khazam et al, 2015) as the tissue changes cannot be completely prevented or compensated for (Esposito et al, 2012; Chen and Buser, 2014; Lin et al, 2014).

The marked alterations after tooth extraction appear to be attributable to the loss of periodontal ligament and the consecutive trauma in particular at the buccal bone plate (Araújo and Lindhe, 2005). In recent years it has been suggested that, in specific clinical cases of immediate implant placement, rather than removing the entire condemned tooth, it could be beneficial to leave a fragment of dental structure (shield) preserving the periodontal ligament – thus avoiding

disrupting the periodontal dynamics and therefore allowing an ideal soft, hard tissue volume and vascularisation.

Several *in vivo* and *in vitro* studies have shown promising results. In 2010, Hürzeler et al described the socket shield technique (SST) with an article that involved the histological evaluation in a beagle dog. The protocol involved the partial extraction of the tooth, leaving a buccal fragment in situ, followed by the immediate placement of the dental implant.

The results showed no resorption of the root fragment and new cementum formed on the implant surface. Furthermore, excellent buccal soft and hard tissue preservation and clinically successful osseointegration of the implant were noted.

Bäumer et al (2015) conducted a pilot study concentrated on the histological, clinical, and volumetric observation of the alveolar ridge and implant after a similar protocol. The results were equally promising and concluded that the periodontal ligament of the tooth segment

remained healthy, there were minor volumetric change of the ridge contour and there was evident direct bone-to-implant contact.

Since then, an exponential number of clinical case reports have emerged, with promising results and with longer follow-ups that have observed the clinical appearance of the peri-implant soft and hard tissues as well as evaluate the volumetric changes of the affected buccal contours in the long-term.

The results available so far seem to point out that the SST may reduce the extent of treatment and decrease patient stress and pain (Hürzeler et al, 2010).

Furthermore, the technique has additional advantages: there is no added cost for materials; comorbidity is reduced; it can be applied in the presence of apical pathology, and it requires reduced surgical intervention (Chen, 2013).

Despite the promising results and the potential benefits reported in the literature, the SST can only be considered suitable for specific clinical cases.

In a five-year follow-up clinical study, Baumer et al (2015) defined the following exclusion criteria for the SST: teeth with present/past periodontal disease; teeth with vertical root fractures on the buccal aspect; teeth with horizontal fractures at/below gum level; teeth with other pathologies affecting the buccal part of the root, for example, external or internal resorptions, except apical pathology; heavy smokers; lack of neighbour teeth; bad oral hygiene; lack of capacity to provide valid consent.

The aim of this article is to describe the use of the SST in the anterior maxilla to attempt to maintain tissue architecture and thus optimal aesthetic results, in a conservative fashion.

Clinical case

The patient (female, 73 years of age) was referred by her general dental practitioner for a consultation with a view to replacing her upper right central incisor. The tooth presented with extensive cervical decay, as evident by the clinical examination and confirmed by the periapical X-ray forwarded by the GDP (Figure 1) and despite the lack of symptoms reported, its restorability was, in the most optimistic scenario, questionable.

The patient dismissed the prospect of having endodontic treatment and a post-crown, and was adamant she would like to have the tooth extracted and replaced with an implant.

She was fit and healthy, reported to have a longstanding prescription of lisinopril, simvastatin and bendroflumethiazide, and had previously been a regular attendee to the dental practice over the years. ▶



Figure 9: Surgical. Frontal intraoral view post implant placement



Figure 10: Surgical. Temporary Maryland bridge in situ



Figure 11: Impression stage – after removing Maryland bridge



Figure 12: Impression coping in situ



Figure 13: Shade selection

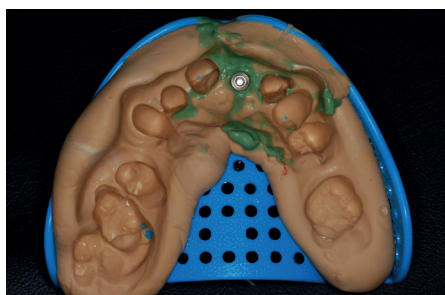


Figure 14: Pickup impression

She presented with a moderately restored dentition, good oral hygiene, and no evidence of other active decay or periodontal disease. She did not smoke and reported consuming alcohol sporadically.

After discussing the different treatment options, the patient consented to have a sequence of clinical records taken, including periapical X-rays, upper and lower alginate impressions, a maxillary silicone putty/wash impression as well as some intraoral and extraoral photographs.

The implant treatment planning protocol that we follow at our practice involves the formulation of an extensive and thorough treatment planning that entails that all the information gathered is compiled and sent to the patient in advance to allow an appropriate time for the information to be read, assimilated and hopefully fully understood.

The patient was presented with two clinical scenarios at the time: a more traditional approach that included the removal of the hopeless tooth followed by either an immediate or delayed implant placement (possibly involving bone and/or soft tissue augmentation

procedures) or alternatively the partial removal of the tooth with the immediate placement of the implant in a flapless fashion (as per the socket shield technique).

After some deliberation, the patient decided to go ahead with the SST as this approach, despite being more recent, less documented and therefore not regarded as mainstream, seemed more conservative and would hopefully diminish the risk of postoperative morbidity and allow a more aesthetic outcome.

The surgical appointment was subsequently booked and, on the day, the patient was given the opportunity to ask any questions about the procedure and risks involved, the consent form was signed and the wheels were set in motion.

No problems or medical changes were reported preoperatively and the patient was given a prophylactic dose of antibiotics – 3g of amoxicillin – one hour before the procedure (there were no reports of allergies or hypersensitivity to any medication).

The patient was then anaesthetised having received two cartridges of Septanest (articaine) infiltrated buccal and palatally, as we routinely

proceed for most surgical procedures.

A strict standardised sterilisation protocol was then followed to prepare the patient and the surgical room, including the placement of sterile draping on all of the working surfaces, usage of sterile gowns and hats on clinical staff and patient.

The patient was then disinfected extraorally and intraorally with a 0.12% chlorhexidine solution and the surgical procedure started with the decoronation of the tooth that was completed with a diamond bur at 1mm above the gingival level (Figure 2), after which the section of the root took place.

This is a very delicate process that starts with the mesiodistal hemi-section of the root, effectively separating it in buccal and palatal fragments (Figure 3). In this instance, it was opted to carefully remove the palatal fragment (Figures 4 and 5), but in certain cases the osteotomy for the implant can even be done directly through the palatal fragment and, once completed, the removal of the proximal/palatal fragments can take place.

It is of utmost importance to ensure that there is no pressure exerted on the buccal shield upon removing the unwanted portions of the tooth as it is essential not to disturb the buccal periodontal area, which is critical for the success of the technique.

The osteotomy was then performed, with a periapical X-ray taken with a parallel pin mid-way through it (Figure 6), to confirm the correct angulation and dismiss any other possible problems, and a 4.0x11.5mm Megagen Anyridge implant was inserted with a torque of approximately 35Ncm (Figures 7 and 8).

The position of the implant in the socket followed the original pathway of the root (Figure 9), parallel to the neighbour teeth and slightly more palatal to ensure that there was no direct contact with the socket shield.

The gap between the implant and the socket shield will then be filled with a blood clot and there is usually no need to use bone augmentation materials or membranes, in this particular case, a portion of collagen sponge (Parasorb) was used.

Some authors believe that using an enamel matrix protein (Emdogain, Straumann) can be applied in this gap and help initiate the process of new cementum formation, which could aid in the prevention of root resorption in the long term (Baumer et al, 2017).

A healing cap was placed and no sutures were needed, and as agreed and planned beforehand, a Maryland bridge was ready to be fitted on the day to adequately provisionalise the area (Figure 10).

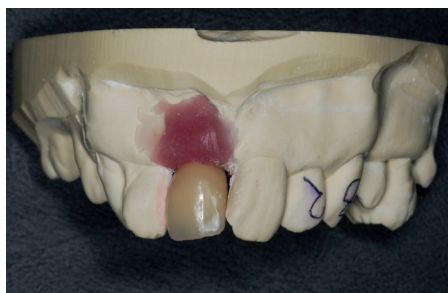


Figure 15: Cast model with crown and artificial gum, frontal view

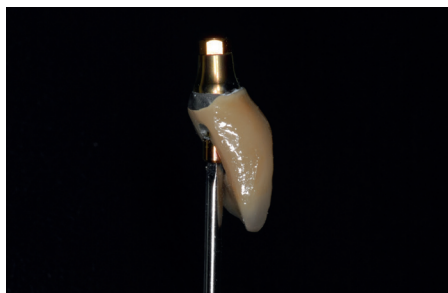


Figure 17: Screw-retained crown



Figure 19: Screw retained crown in situ, occlusal view



Figure 21: Smile, frontal view

The technicians were instructed to construct the bridge with an anatomy that would not exert unwanted pressure on the underlying soft tissue and the patient was very happy with the result at that stage. The patient was given comprehensive postoperative instructions including rinses with 0.12%

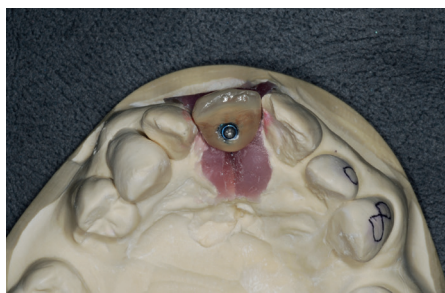


Figure 16: Cast model with crown and artificial gum, occlusal view



Figure 18: Screw-retained crown in situ, frontal view

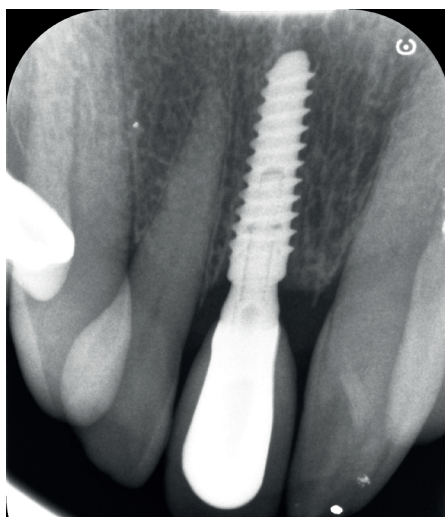


Figure 20: Periapical X-ray after crown fit



Figure 22: Smile, facial view

chlorhexidine mouthwash three times a day for the first week and she was advised to take paracetamol and/or ibuprofen three times a day for the first 72 hours.

The patient was reviewed after a week, reported no postoperative discomfort and clinically the soft tissue and temporary

The socket shield technique may reduce patient stress and pain

bridge were looking fine with no evidence of inflammation or other ill symptoms.

Eleven weeks after this, the patient returned in order to assess the osseointegration of the implant and the appearance of the surrounding soft tissues. A periapical X-ray taken at this time showed a favourable outcome with a satisfactory presence of bone around the implant and in between the threads, and also that the soft tissue volume remained stable and healthy looking (Figure 11).

The patient reported no discomfort and had been quite happy with the temporary Maryland bridge – that eventually needed to be removed to allow for the impression to take place and recemented back (Figures 12-14).

She returned two weeks later to have the final screw-retained crown fitted (Figures 15-19), the patient was happy with the appearance of the restoration and consented to proceed. After confirming the correct position of the fixtures with a periapical X-ray (Figure 20), the crown was positioned, torqued to 25Ncm, as per the manufacturer's advice, and the palatal access covered with flowable composite following the placement of some Teflon to protect the screw access.

The occlusion was checked and no adjustments were necessary (Figures 21 and 22), the patient was then instructed in regards to the oral hygiene (regular visits to the hygienist were recommended) and was advised to return for a review.

After 12 months, the patient was again reviewed and reported no problems and she was over the moon with the results. Furthermore, the volume of soft tissue seemed to have been maintained, there were no evidence of inflammation or other ill symptoms (Figures 23-26).

Conclusion

It is an exciting time to be a dentist. The ongoing clinical and scientific research is constantly providing us with new and improved treatment options to help our patients in the best possible way, and it is our mission, as modern dentists, to be up to speed with the breakthroughs in our field.

The SST has now been documented for several years and the results obtained are incredibly promising and increasingly supported by the clinical data that is emerging. ►

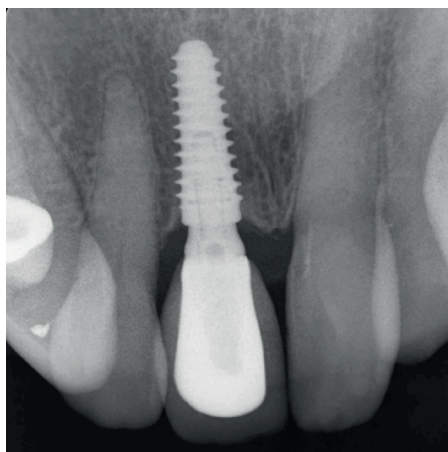


Figure 23: 12-month follow-up. Periapical X-ray



Figure 24: 12-month follow-up. Intraoral picture, frontal view



Figure 25: 12-month follow-up. Intraoral picture, right view



Figure 26: 12-month follow-up. Intraoral picture, left view

Nevertheless, it is of utmost importance that, whatever treatment options you and your patient decide on, they should be clearly and meticulously discussed and individually assessed, namely in regards to the case/patient selection and the experience and clinical confidence of the dental surgeon.

In this particular case, the SST proved to be – so far – an excellent option as it allowed optimal results in soft and hard tissue volume with a very low co-morbidity associated, which has pleased both the patient and the clinicians immensely.

In conclusion, it is the authors' opinion that it should be advisable to keep a critical spirit towards less conventional techniques, and the SST is at this stage regarded as so, but the conservative principles that it stands on, and the promising clinical data that is continuously being released, may well demand that it should be regarded as a more mainstream approach in the years to come. **IDT**

This clinical case was first presented at the ICE Postgraduate Dental Institute & Hospital and Edge Hill University as a part of the MSc in Dental Implantology.

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