Complication Management of a Socket Shield Case After 6 Years of Function

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Maintaining soft and hard tissues around dental implants after tooth extraction is one of the major challenges in implant dentistry. After tooth extraction, the subsequent loss of bone and soft tissue is inevitable due to the partial resorption of the buccal bone plate. The recently described socket shield technique addresses the problem by maintaining the buccal piece of the tooth in the extraction socket in order to preserve the buccal bone. As with every new technique, specific complications, like infection of the buccal piece of the tooth, can occur. Herein, the authors present a clinical case that developed a complication with the socket shield technique and the consequential surgical management.


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Submitted September 20, 2019; accepted November 17, 2019.
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implants: palatal/lingual implant position, platform-switched abutments, bone grafts between the implant and the buccal bone, flapless approach, connective tissue grafts, and immediate provisionalization.

Only the palatal/lingual placement of the implant was able to reduce the mucosal recession with a high level of reliability in the immediately placed implant. The rest of the techniques showed conflicting results, and no technique could completely stop the resorption process that leads to recession. After a recession has formed, it seems very challenging to achieve a complete reconstruction of the defect.

In 2010, Hürzeler et al addressed the underlying problem of resorbing the buccal bone directly by proposing to keep the buccal part of the tooth to be extracted in place. In a 5-year follow-up clinical study, minimal changes of the peri-implant soft tissue were depicted using this new technique. At the same time, the approach was less invasive than other augmentation techniques and a high esthetic score was reported. In the last years, a variety of different studies and case reports using the same or modified socket shield techniques have been published with promising results.

However, there are reports of complications, such as resorption of the shield. In these two published cases, resorption of the remaining dentine was confirmed. Neither working group initiated any therapy, and the incidents did not affect the success of the implants. In the following case report, though, surgical intervention was necessary because of patient complaints and clinical deep probing depth with bleeding on probing. It was obvious that after 6 years, the shield became mobile after successful implantation with the socket shield technique. The shield needed to be removed and a guided bone regeneration technique was applied to overcome the complication on this implant in the esthetic zone. The 1-year follow-up after the complication management demonstrated a stable situation.

Case Report

In 2011, a 60-year-old patient presented with a vertical fracture of the endodontically treated maxillary left central incisor (Fig 1). A treatment plan was developed to proceed with extraction utilizing the socket shield technique for immediate implant placement.

After medical information and discussion of treatment alternatives, the patient decided for an immediate implant in combination with the socket shield technique. The tooth was decoronated, further split using carbide burs as well as a straight desmotome (Deppeler) and partially extracted. The buccal root plate was left in place as a shield. The bone walls of the alveolae were thoroughly cleaned with the help of an excavator. Afterwards, a 5.0 × 14.0-mm implant (SPI implant system, Thommen Medical) was inserted using the Chiroplo L implant handpiece (Bien Air) and a manual torque driver (SPI implant system, Thommen Medical). Immediate provisionalization was performed, and the provisional crown was taken out of occlusal contact (Fig 2).

The healing process passed without any problems. Five months later, impressions were taken and the final restoration was placed by the referring dentist (Fig 3).

In 2012 the patient returned for checkup, impression-taking, and photos. The situation was stable and there were no clinical signs of infection or other posttherapy complications (Fig 4).

In 2017, the patient was referred to the practice again with problems...
around the implant in the maxillary left incisor. The shield around the buccal aspect of the implant was mobile and a deep, 8-mm buccal probing depth could be detected. The incisal edge of the implant crown was in a lower position compared to the adjacent tooth, suggesting an ongoing vertical growth of the neighboring tooth (Fig 5a).

It was decided to perform surgery to remove the shield with the surrounding inflammation and fill the defect with a bovine bone material (Bio-Oss, Geistlich). At first a sulcular incision was performed extending from tooth 11 to tooth 24 (FDI system). The papillae needed to be sharply dissected in order to gain enough sight for the surgery and carefully remove the mobile shield. The mobile shield was reduced in height coronally with a diamond bur, allowing the subsequent removal with a straight desmotome (Deppeler). The remaining buccal bone could be preserved, and the defect was thoroughly cleaned using curettes and an airflow device with erythritol powder (Perioflow and Airflow, EMS). Afterwards, the defect was filled with bovine bone particles (Bio-Oss, Geistlich Pharma) up to the top of the buccal wall. To thicken the tissue and to achieve a more secure coverage of the defect, an autogenous connective tissue graft for coverage was taken from the tuberosity. The graft was meticulously deepithelialized using a blade and half split in the middle to achieve a better adaptation over the defect. These surgical steps are demonstrated in Figs 5b to 5e. The flap was repositioned and sutured with a 7/0 suture (Seralene DS 15, Serag-Weissner). The patient was instructed to refrain from cleaning in the surgical area and instead rinse three times daily with a 0.12% chlorhexidine liquid until removal of the sutures. The healing process was uneventful, and the sutures were taken out 7 days later.

In 2019, 12 months after the correction, the patient was examined and a stable situation was observed. No inflammation or mobility was seen. The soft tissue around the implant showed a recession, and the papilla adjacent to tooth 11 was reduced in height. Scar tissue around the implant could be observed. Radiographs showed no irregularities around the implant, and the patient did not report any complications (Fig 6).
Discussion

The socket shield technique in the esthetic zone shows promising results in maintaining the soft and hard tissues around implants and providing a possible solution for a reliable esthetic outcome.\textsuperscript{14–31} However, certain problems have been reported in the literature and addressed by some authors.\textsuperscript{30,32} The presented case demonstrated a way to address a possible complication.

The presented complication can by hypothesized. It is well known that the maxilla grows in an anterior-caudal direction for lifetime.\textsuperscript{33} The clinical 6-year follow-up (Fig 5a) depicts the anterior-caudal growth in the presented case. The natural tooth (no. 11) is in a more coronal position than the adjacent implant. Looking at the reentry situation (Fig 5b), it can be noticed that the shield moved coronally until it contacted the crown on the implant. It seems that the shield was prepared too short in an apico-coronal direction (Fig 2a). Therefore, the shield was not locked with either the implant threads or with an ingrowth of bone, ankylosing the shield. Hence the shield acted like a natural tooth, in terms of vertical displacement, by following the growth of the maxilla. Since the implant was ankylosed, the shield came into contact with the implant-retained crown after some years of function. This allowed bacteria to migrate into the space between the implant and the shield. The resulting inflammation was the reason for the patient’s visit to the office. It needs to be emphasized that, according to the initial publication of Hürzeler et al,\textsuperscript{12} the thin buccal bone plate could be completely preserved over 6 years despite the inflammation. In order to prevent this kind of complication, either a tight contact between the implant and buccal root plate should be favored or the shield should be prepared long enough in the apico-coronal direction that it allows the bone to grow between the implant surface and the shield, for an ankylosis between implant and shield.\textsuperscript{12} The subsequent ankylosis keeps the shield from moving along the direction of the skeletal growth.

\textbf{Fig 5} (a) Six years after treatment, the patient returned with an apico-coronal displacement of tooth 11 and a slightly inflamed situation around the implant. (b) After elevating a flap, the mobile shield could be seen in contact with the crown on the implant. (c) Only a small amount of the implant surface was exposed. (d) The defect was filled with bovine bone particles (Bio-Oss, Geistlich). (e) The bovine bone particles were covered with an autogenous connective tissue graft from the tuberosity.
In the literature today, there is only a small amount of data available for complications with the socket shield technique. Prior to the first publication of the socket shield technique, Davarpanah and Szmukler-Moncler published a case series of five patients with a total of five implants, where the authors tried to avoid the traumatic extraction of ankylosed teeth by leaving remnants of the root in place before placing the implant. Although they did not exactly follow the later-published concept of the socket shield technique, the implications in terms of development of complications are comparable to the complications in the socket shield technique. In their case series of five patients, one patient developed a small resorption of the remaining dentine plate, but this did not affect the overall implant success after a follow-up period of 49 months. The authors attributed the complication to an occlusal overload.

Another overall successful case report of the socket shield technique by Cherel and Etienne showed an exposed dentine fragment in the emergence profile when placing the final crowns after 4 months of immediate provisionalization and implant placement. The dentine fragments exhibited no signs of mobility or surrounding inflammation and thus were rated as a success.

Siormpas et al reported one failure in their retrospective analysis.
of 46 implants over a period of up to 60 months.\textsuperscript{30} The patient initially presented with an extensive apical defect in the maxillary central incisor that was treated by extracting the tooth and placing an immediate implant with the socket shield technique. After a 3-year follow-up, the apical defect radiographically showed uneventful healing, but a 1.5-mm apical resorption of the shield was observed. The cone beam computed tomography scan at the 48-month follow-up revealed no progress in resorption. The functional and esthetic implant success was not impaired due to that event.

In 2015, Lagas et al reported in a case series of 16 patients (one implant per patient) the failure of a shield in one patient. The patient presented with a mobile dentine shield, which was removed. In a second surgical procedure, a connective tissue graft was used to correct the defect, and a satisfactory esthetic outcome was observed. The authors attribute the complication to insufficient removal of restoration material in the previously partially extracted tooth.\textsuperscript{34}

A systematic literature review by Gharpure and Bhatavadekar also had the intention to identify possible complications in the socket shield technique.\textsuperscript{35} In their review, four histologic studies and 19 clinical studies were included, most of them case presentations with one implant placed. The authors of the literature review found an overall complication rate of around 25\% (total: \( n = 33 \)) in implants placed with the socket shield technique in clinical cases and a complication rate of up to 83\% (total: \( n = 58 \)) in implants placed in animal studies.

At this point, it needs to be emphasized that the systematic review\textsuperscript{35} did not differentiate between the originally published socket shield technique and the T-Belt technique. Out of 58 published failures of implants in preclinical studies, 54 were not treated with the original published socket shield technique. The failure rate in animal studies with the socket shield technique seems to be very low.

The 19 clinical studies in the review\textsuperscript{35} reported 33 out of 136 implants as failures. A closer look at the underlying data reveals that 10 out of the 26 implants had a bone loss of 1.3 \( \pm \) 0.2 mm at 6 months. All of these implants come from the Troiano et al study\textsuperscript{31} and were not placed with the socket shield technique but with the T-Belt technique. The other 16 implants classified as a failure of bone loss showed a bone loss of around 0.8 mm after 3 to 24 months. It remains a point of discussion whether this amount of bone loss is to be classified as a failure. Another 7 failed implants showed shield exposure, deep probing depths, and deficiency of alveolar ridge. Taking out the implants placed with the T-Belt technique, the complication rate is down to 17\%, or 23 out of 136 implants.

Gharpure and Bhatavadekar\textsuperscript{35} also stated that a small number of studies reported the majority of failed implants in the socket shield technique, and they derive that this could be traced back to a certain amount of technique sensitivity.

Except for the four studies reporting failures in the socket shield technique and the systematic literature review by Gharpure and Bhatavadekar,\textsuperscript{35} there are no further reports of complications in socket shield therapy. In the majority of the cases, no additional treatment was necessary, which was agreed on following consequent follow-ups. In one case, surgical intervention was performed and a satisfactory esthetic result was achieved.\textsuperscript{34}

Conclusions

This case presentation shows that a long-term failure in the socket shield technology can occur, but the complications are manageable. It is obvious that this is an evolving technique with a learning curve. To consistently apply this technique within the implant therapy, more research and more clinical control studies are needed in order to mitigate the risk of possible failures. Identifying possible risk factors and complications with the socket shield technique is essential for its successful application in today’s implant therapy.

Acknowledgments

The authors declare no conflicts of interest.

References