A biological approach is mandatory as implantology enters more and more intensively into the contemporary dental practices. Immediate implant placement is widespread procedure in implant dentistry. The increasing patient’s demands make us look for new ways for more predictable and reliable treatment healing procedures especially when it is for the the aesthetic zone. Various alveolar ridge preservation procedures and combinations of different techniques have been described and it is said that immediate implantation also plays an important role in preserving the bone volume of the alveolar process.

Besides shortening the duration of treatment, preserving the alveolar ridge is one of the primary goals of immediate implant placement. A number of studies of Hürzeler MB, Zuhr O (1) have shown that immediate implantation in fresh extraction sockets yields a prognosis similar to that of implants placed in healed extraction sites.

The strategy of retaining the buccal root fragment of the extracted tooth in combination with immediate implant placement may prove to be an effective means of alveolar ridge preservation.

The clinical study of Hürzeler et al, suggests that retaining roots of hopeless teeth may avoid tissue alterations after tooth extraction. Therefore, the objective of this proof-of-principle experiment was to histologically assess a partial root retention (socket-shield technique) in combination with immediate implant placement.

According to this study the results are optimistic: the implants have been osseointegrated without any histologic inflammatory reaction and the tooth fragment has been devoid of any resorption processes. On the buccal side, the tooth fragment has been attached to the buccal bone plate by a physiologic periodontal ligament. On the lingual side of the fragment, newly formed cementum could be detected. In the areas where the implant has been placed into the fragment, newly formed cementum has been demonstrated directly on the implant surface.

Another clinical study of Gluckman H et al (5) from 2016 demonstrates the pontic shield technique. In this way the alveolar ridge is also preserved and it is very suitable where the root submergence technique is
not possible. The research continues in 2017 with a concept which proposes a paradigm shift away from extract and augment toward partly retaining the tooth root to preserve the ridge and prevent buccopalatal collapse.

The revolutionary socket-shield technique was introduced in 2010 and entails preparing a tooth root section simultaneous to immediate implant placement and has demonstrated histologic and clinical results that are highly promising to esthetic implant treatment.

Collectively, the above mentioned techniques may be called partial extraction therapies (PET).

According to various studies by authors Petsch M et al there are various modifications of techniques for leaving part of the root in order to preserve the vestibular contour of the bone and minimal or no loss of the alveolar ridge. The socket shield technique has shown its potential to prevent resorption of buccal tissues.

Clinical Case

A clinical example of the socket shield technique. A 46 years old, non-smoking, female patient came to the dental office complaining of a problem in the aesthetic area.

Fig. 1 Initial view with smile

The detailed anamnesis and intraoral examination presented an oblique crown fracture of the left maxillary incisor temporarily restored with composite resin. After an intraoral and radiographic examination a periapical lesion together with root resorption was detected after unsatisfactory endodontic treatment.
Fig. 2  Intraoral view
Fig. 4

Fig. 5  Clearly visible the tooth fracture
Initial radiographic examination, cone beam computed tomography analysis prior to treatment revealed insufficient buccal bone plate and periapical lesion of the same tooth. Different options for treatment were discussed subsequently. The treatment plan included two stages: firstly biological approach to remove the granulation and inflamed periapical tissues (apicoectomy) and procedure for guided bone regeneration (GBR) using allograft material (Puros Allograft, CopiOs Pericardium Membrane). The broken tooth was fixed back and served as a provisional restoration. After a complete healing process, 6 months later followed the second step.
Fig. 9
Control CBCT and radiographic examination after the first stage of the treatment showed complete healing process. The result is a sufficient buccopalatal volume of bone, that allows the transition to the second stage of the treatment. Plan-immediate implant placement using the socket shield technique for preserving the alveolar ridge.
Front view of the defect

Conservative removal of the palatal root fragment and the remaining buccal part of the root. The pulp chamber was used as initial guide to achieve maximum control and simplify the osteotomy. After full-depth implant site preparation, the remaining root was sectioned mesially and distally with a Lindemann Bur (Hu-Friedy) and carefully removed except for the buccal aspect. The retained buccal part was prepared for socket shield technique.
Fig. 14  Placing the control pin
Control X-ray to ensure the correct positioning of the implant.
An implant was inserted, torque controlled (Zimmer-Biomet TMM 4.1x11.5 mm Trabecular Metal Implant) using surgical contra-angle and placed in slight contact to the retained buccal root fragment.
Occlusal view of the implant in contact with the retained labial part of the root.
The stability of the implant was evaluated using an ultrasound method in terms of ISQ units (Osstell Mentor; Integration Diagnostics, GÖteborg, Sweden) during the surgery. Two measurements were performed with a torque wrench, on the vestibular and mesial sides, and the average value was recorded.

Due to the high initial stability of the implant (35 N·cm or more, ISQ above 72) achieved, an impression for a provisional crown for immediate loading was taken.
The field was isolated with a sterile rubber dam. The shape of the restoration was designed using CEREC 4.0 and was milled in the CEREC Milling Unit. Lava Ultimate blocks was used for the fabrication of the crown. Mattress stitches were placed with 6/0 monofilament PTFE sutures (Omnia, Italy). The restoration was out of occlusion. The patient was called for follow-up visits 3, 10 and 15 days after the surgery. The sutures were removed on the 10th day after surgery.
Provisional crown was placed after the surgery. The multiunit tapered abutment allows a bone level implant to be used as a tissue level implant. In this way a temporary crown can be fixed without inducing tension on the implant platform and without compromising the good oral hygiene. The two screws provide for a certain degree of protection of the implant body, transferring the load to the gingival level. The different heights, diameters and angles of the multiunit abutments allow for the achievement of an individualised emergence profile.
Fig. 23 From occlusal direction it is clearly visible the bone level.

Fig. 24 Side view of the emergence profile.
Six months after the surgery an impression for second provisional crown was taken. After removing the crown a healthy soft tissue interface was noted.
An open-tray impression was taken and sent to dental technician laboratory. A second provisional crown was fabricated by Dr. Vincenzo Musella MDT.

The second screw-retained provisional crown over implant. The provisionals played an important role in the healing process and also with achieving the optimal emergence profile according to the biological nature of soft tissues. In this way the emergence profile is not changing in vertical and horizontal dimensions. The patient was instructed in careful oral hygiene. The follow up visits were performed 1 month and 3 months postoperatively.
Six months later the second provisional crown was removed and impression for final crown was taken. A healthy soft tissue was present with little if any changes in the buccal contour.
A prefabricated screw-retained implant transfer was customized using a light-curing resin (G-ænial™ Flo & G-ænial™ Universal Flo). The subgingival contours were supportive of the soft-tissue profile. However, care was taken not to apply pressure on the remaining tooth fragment. The customized implant transfer was mounted to a laboratory analog, replica to immediately transfer the achieved subgingival profile.
Fig. 32  
The biscuit try-in of the fabricated all ceramic crown over implant by Dr. Vincenzo Musella MDT.
Fig. 33
The final crown on the model after the definitive corrections of the colour and shape.
The final result immediately after the cementation from frontal and occlusal view. Intraoral occlusal view shows no changes in buccal soft tissue comparing to pretreatment situation and equivalent volume to the contralateral incisor, even without augmentation. The zirconium dynamic abutment was screw retained with a ratchet (30Ncm) and the access hole was sealed with Teflon tape. Rubber dam was placed and the final crown was adhesively cemented with RelyX Unicem (3M) under field isolation.
The final result after 1 year. A good integration of the single crown over implant. A side view. Healthy peri-implant tissues with little or any volumetric loss.
The suggested method is showing a two-step approach for a compromised maxillary central incisor.

After tooth extraction in infected sites usually changes of the alveolar ridge occur and require tissue grafting after the infection has been completely removed, often as a part of a second surgery few weeks after the extraction. This period is inconvenient for the patient, because of the grafting procedure and the compromised provisional restoration- denture, essex retainer or adhesive bridge.

The preliminary treating of the infection in the apical area is keeping the tooth as a provisional restoration and making the surgery procedure less invasive.

Few months after that procedure, immediate implant placement could shorten the overall treatment time and can facilitate good esthetic results. However, to achieve optimal results, simultaneous augmentation procedures to compensate for horizontal and vertical remodeling are still necessary.

Many authors advocate a submerge of part of the roots for keeping the ridge volume. Some of them submerge vital roots for pontic site development. Other studies show that the PET technique is leading to conservation of the periodontal ligament, preventing resorption of the buccal bone plate and therefore preserved the natural contour of the alveolar process. In another study, dental implants inserted through impacted teeth with a follow-up of up to 8 years did not show any signs of inflammation or bone resorption. Furthermore, histologic examination showed intimate contact between the implant surface and the root and formation of cementum on the surface of the implant without pathologic inflammatory signs. These findings are in accordance with other studies that could not find any negative biologic response. It can be concluded that the socket shield technique does not interfere, at least in the short term, with the function or biology of titanium oral implants.

The technique with the drilling through the root, that is used in the presented clinical case is allowing the clinician to position the implant palatal in order to be able to make a screw retained crown and to keep the buccal part (the shield with the bundle bone) of possible breaking of the cortical bone.

The immediate provisionalisation with a two piece abutment is distributing the stress far away from the implant body and is allowing the functional loading to enhance osseointegration.

The trabecular surface of the TM implant is making a contact with the cementum of the tooth. Because of its cylindrical shape, the risk to break the shield is reduced.

Consequently, in such cases it is even more important to preserve as much tissue as possible over time and prevent the need to augment tissues. However, the applied technique enabled the authors to maximize tissue stability and reduce surgical intervention to a minimum. As all alternative treatment options were discussed with the patient, the presented technique proved to be a reasonable choice considering risk versus gain. Not enough human-derived histologic examinations are currently available- only one study is showing cementum growing on the implant surface, but many studies are showing now good long-term clinical outcome. Before integrating this protocol on a daily basis, long-term studies and histology are required to show long-term success of the socket shield technique.

Hürzeler et al and Bäumer et al describe the use of a labial shield, Kan et al leave a shield at the proximal area to preserve the papilla. According to the literature different modalities of the same technique seem feasible. There is no evidence, regarding the ideal clinical situation for the socket shield technique.
The ideal case should be an oblique crown root fracture on a vital tooth, fully intact on the labial aspect with no clinical signs of periodontal inflammation.

According to our experience of that technique we had a proper case selection:

The remaining root, its hard tissues, periapical tissues and its periodontal ligament must be healthy, without mobility or radiologic or clinical pathology.

Internal and external resorptions, endodontic perforations, or infections on the labial aspect are contraindications.

Healthy periodontium and no acute periodontal disease or lesions.

Thick buccal bone wall- it could be fractured easily with the remaining plate.

Fractured or endodontically treated teeth are feasible if the remaining parts are healthy and cover the desired aspect of the socket.

The existing evidence for periapical pathology as a risk factor for the survival outcome of post extraction implants is contradictory. More of the authors remain cautious regarding existing periapical infections. That is why the presented clinical case is showing more predictable two step approach for treating the periapical infection and the root resorption first and then to execute predictable the socket shield technique.

In this case report, a hopeless fractured maxillary central incisor was replaced by an immediately placed implant using the socket shield technique in combination with a zirconium dynamic abutment with all ceramic crown. Despite a thin biotype, the peri-implant tissues could be well preserved over time and a result could be achieved that was regarded a success by the patient. With some limitations and careful selection of the case, this treatment modality may to be suitable for esthetically challenging anterior single implant restorations.