Introduction

Implant therapy success, especially in the anterior maxilla, is judged not only by osseointegration but also by the presence of sound and stable peri-implant tissues that appear identical to the gingiva surrounding the healthy adjacent teeth. Predictable peri-implant esthetics created immediately after tooth removal requires proper preservation, and often augmentation, of the osseous and soft tissues surrounding the failing tooth, proper three-dimensional implant placement, and proper planning and design of the prosthetic steps following the surgery. Extraction sites in the anterior maxilla present the greatest restorative challenges due to the need for high-quality esthetic results. Implant placement into fresh extraction sockets without using flap elevation has recently become more popular as a treatment modality. This is due to the reduction of bleeding and swelling and the preservation of the existing bone and soft tissue volume, yet this surgical procedure requires thorough planning and expertise.

When no flap is to be elevated it is imperative to study the bone morphology through cone-beam computerized tomography in order to plan not only exact implant positioning but also the augmentation steps necessary during implantation. Case selection for this treatment modality must be based on rigorous criteria, and in all cases where esthetics are of primary demand, immediate placement and provisionalization should be performed only when the supportive tissues are intact or there is no need for excessive augmentation. This excludes almost all cases where the tooth is to be replaced due to periodontal disease or where the bone and gingiva are already degraded substantially. Even when the supporting tissues are in a perfect condition, the consequences of tooth extraction – ie, loss of periodontal ligament (PDL), bundle bone resorption, etc. – mean that it is advised to fill the peri-implant socket gap after implant insertion with a slow absorbable cement-like bone substitute, to preserve the initial bone volume. In the majority of cases where the gingival biotype is not a very thick type it is also desirable to place a connective tissue graft over the implant, under the buccal flange, to thicken the tissue, especially during the early stages of healing. This is mandatory when dealing with a thin biotype, but it is recommended for any kind of treated biotype.

Thus flapless implant insertion into fresh extraction sockets and placement of an immediate provisional crown in the maxillary anterior region represents a viable treatment option in appropriate clinical situations where esthetics are of a high priority.

Although the impacts of each of the various possible restorative procedures on esthetics are still being studied, the immediate single-tooth implant has become a viable treatment option. In a recent comparative study, the soft tissue outline was examined at immediate implant sites after two restorative protocols: (1) immediate connection of a provisional crown and (2) submerged healing, during which a removable partial denture was used. The results showed that implant survival, bone remodeling, probing depth, and bleeding tendencies were not influenced by the restorative protocol. Delayed restoration resulted in initial papilla loss, taking up to 1 year to attain a height comparable with that achieved by immediate restoration. Moreover, midfacial recession was systematically 2.5 to 3 times higher after delayed restoration than with immediate restoration after 1 year. It was concluded that if the primary implant stability permits, immediate single-tooth implants should be immediately provisionalized in the interest of optimal midfacial esthetics.

In another study, the soft tissue and esthetic outcomes were assessed at single-tooth immediate implants placed without flap elevation in maxillary central and lateral incisor sites. Photographic records of 85 consecutive patients were selected. The change in mucosal level was expressed as a
percentage of the length of the reference central incisor. The results showed there was significant recession of the mesial and distal papillae and facial mucosa between surgical placement and 1-year follow-up. Recession was greater for implants placed facially within the extraction socket compared with those placed lingually. Sites with gingival margins that were initially coronal achieved mucosal levels close to the line of symmetry with the contralateral tooth. Level or apical initial sites failed to reach the line of symmetry and remained receded. Recession occurred more often in the thin biotype sites than thick biotype sites, but “acceptable outcomes” were achieved in most sites. It was concluded that immediate implant placement without surgical flap elevation is associated with recession of the marginal mucosa that may fall within the threshold of visually detectable change. It was concluded that the orofacial position of the implant shoulder and the tissue biotype are important contributory factors to the esthetic outcome.

The esthetic outcomes of 42 nonadjacent single-unit implant restorations, completed using an immediate implant surgical placement protocol, were analyzed in a retrospective review. A highly significant change in crown height due to marginal tissue recession was recorded for all sites, with no differences observed between the implant systems utilized. Thin tissue biotype showed slightly greater recession than thick tissue biotype, but the difference was not statistically significant. Implants with a buccal position showed three times as much recession as implants with a lingual position; this difference was statistically significant.

Through a systematic review of the literature, the outcomes of single-implant restorations in the esthetic zone with natural adjacent teeth have been studied, thereby addressing immediate, early, and conventional implant approaches. Meta-analysis showed an overall survival rate of 95.5% after 1 year. A stratified meta-analysis revealed no differences in survival between immediate, early, and traditional implant strategies. Little marginal peri-implant bone resorption was found, together with low incidence of biologic and technical complications. No significant differences in outcome measures were reported in clinical trials that compared immediate, early, and conventional implant strategies. The literature suggests that promising short-term results could be achieved for immediate, early, and traditional single-implants in the esthetic zone. However, important parameters, such as esthetic outcome, soft-tissue aspects, and patient satisfaction, were clearly underexposed. The question of whether immediate and early single-implant therapies would result in better treatment outcomes remains inconclusive due to lack of well-designed controlled clinical studies.

**Techniques**

Single-rooted teeth might be candidates for implant placement at the time of tooth extraction. Immediate implant placement is believed to preserve soft and hard tissue form and contours, reduces the extension of augmentation procedures, minimizes surgical exposure of the patient, reduces treatment time, and improves esthetic outcomes. Although it is now possible to place immediate implants and immediate prostheses to improve esthetics and to simplify the procedure, the long-term stability of buccal mucosa when using this technique is still controversial. There are few protocols that relate to novel implant systems especially designed for immediate placement and loading for the purpose of bone and soft tissue stabilization. An early study describes a technique called socket seal surgery, which combines bone substitutes and soft tissue grafting, performed simultaneously with implant placement. However, using this technique, the implant head is completely covered, hence immediate provisionalization is not possible.

Minimally invasive extraction and immediate implantation was described using a flapless implantation technique. In the pioneer publication on the topic of flapless immediate implantation, the authors described a technique that does not require any incisions (today known as flapless) during extraction and immediate implant placement. No barrier membrane was used and the sole grafting material used was autogenous bone chips. Since the method did not include loading, full soft tissue coverage was achieved 1 to 8 weeks postimplantation. Clinical osseointegration was achieved with minimal gingival recession and papilla preservation. The conclusion was that immediate implant placement in the anterior maxilla can be successful for replacing a single tooth, even without primary closure.

Another approach was introduced to maintain soft tissue health and support following immediate implant placement and immediate insertion of minimally functional single-unit screw-retained fixed provisional restorations. The study describes immediate provisionalization of immediate implants, including modification of the patient’s natural clinical crown for use as the provisional restoration in the anterior segment. The use of existing crowns as the provisional restorations allows the patient to leave on the day of surgery with essentially the same esthetic condition in which they arrived. Patients find it reassuring to know that they will be able to wear their own tooth as a fixed provisional crown. This is particularly important in terms of minimizing the sense of loss that is invariably experienced by patients as they go through the process of replacing a tooth in the esthetic zone.

Another recommendation aimed at increasing buccal tissue thickness is to use transmucosal concave abut-
correlated with a thick gingival biotype. It was also concluded that the presence of papillae is also a function from the contact point to the interdental bone is <7 mm. Recommended interproximal distance between the implant and opposing tooth is 2.5 to 4 mm, and their recommended distance from the contact point to the interdental bone is <7 mm. It was also concluded that the presence of papillae is also correlated with a thick gingival biotype.

Another report analyzed the surgical, prosthetic, and anatomic factors involved in the management of peri-implant tissues following tooth extraction and immediate implant placement. After healing, implants were restored with single-crown fixed prostheses. The authors concluded that the combination of surgical and prosthetic plans represents the key factor for optimizing predictability in single-implant esthetics. Their recommended interproximal distance between the implant and adjacent tooth is 2.5 to 4 mm, and their recommended distance from the contact point to the interdental bone is <7 mm. It was also concluded that the presence of papillae is also correlated with a thick gingival biotype.

Another study compared the aesthetic success of immediate flapless implants with that of immediate implants with the need for flap elevation and of delayed implants in single-tooth restorations in the anterior region of the maxilla. It was evident that papilla was present 100% of the time when the distance between the base of the contact point of crowns and height of interproximal bone was less than 5 mm. However, papilla was present also 46.5% and 24% of the time when the distance increased to 6 mm or more than 7 mm, respectively. These findings lead to the practical conclusion that it is always worth making the distance as large as esthetically possible and to let the papilla fill the space, as statistically there is a 20% chance of a space more than 7 mm being filled.

In an effort to obtain answers to some controversial points pertaining to esthetics and function of implants in the maxilla, immediate flapless implantation into extraction sockets in the maxillary anterior zone became a proven treatment option.

**Flapless implant surgery**

Flapless implant surgery has been suggested as a possible treatment option to enhance implant treatment esthetics. Some reports indicate that creeping attachment (ie, soft tissue recovery) could occur within 2 months.

Flapless implant surgery has been shown to provide esthetic soft tissue results in single-tooth implants either with immediate loading or with delayed loading.

Immediate postextraction placement of implants without incisions or flap elevation is a surgical treatment option that might improve the healing and regenerative potentials of the fresh socket – unlike when a flap is raised, the only damage to the nutrition sources to the treated area is the elimination of the PDL vasculature.

Immediate placement in fresh extraction sockets in the anterior maxilla without incisions or flap elevation can ensure ideal peri-implant tissue healing, preserving the presurgical gingival and bone aspects. For a predictable esthetic result, the most important factors are the height and thickness of the buccal bone wall and the interproximal peak of bone that remain after immediate placement of the fixture. A prerequisite for this minimally invasive approach is the existence of healthy and sound bone and gingiva around the extracted tooth. Hence, the clinical indications for such a technique are situations where the prognosis for restoring the damaged tooth is poor or hopeless (cracked tooth, deep coronal fracture, deep decay, etc.) but the periodontium is healthy. In cases where the tooth is removed due to periodontal breakdown, this simplified approach is usually not applicable due to the need for tissue regeneration (hard, soft, or both) prior to or simultaneous to implant placement.

Extraction sites in the esthetic zone present an obvious restorative challenge. Clinical success may be attributed to several important features of the surgical technique. The first step involves delicate extraction using periotoms and designated corkscrew extractors through a flapless or minimally invasive approach to reduce trauma to the adjacent tissues. The second step involves appropriate orientation, placement, and stabilization of the implant to preserve facial bone and soft tissue contours. Implant placement is simultaneously accompanied by gap filling using a slow absorbable material to achieve long-term ridge preservation. A connective tissue graft is highly recommended to thicken and stabilize the buccal gingiva after rupturing the PDL. Finally, preservation of the original soft tissue architecture during wound healing is essential. This is achieved by connecting the appropriate transmucosal prosthetic unit.

Immediate implant placement requires very careful case selection, thorough preoperative 3D planning and experienced surgical and prosthetic operators if esthetic outcomes are to be achieved. Long-term prospective studies on tissue stability (and esthetic outcomes) achieved by the different clinical techniques for immediate implantation and restoration are still to be determined.

**Restorative options**

The optimal provisional restoration for any implant would be a custom-made prefabricated restoration that achieves three main requirements:

- **Functional coronal positioning against the antagonist teeth and integration with the adjacent teeth.** In immedia-
Tissue management and prosthetic considerations with immediate implantation in the anterior maxilla

- Apical engagement to the implant. This can be achieved either directly, using a screw-retained provisional crown, or indirectly, through an intermediate screwed abutment onto which the provisional crown is screwed or cemented. In cases of immediate implantation when the epithelial attachment has not yet been established and there is no biologic seal around the freshly placed implant, a cemented crown presents the risk of cement entrapment beyond the abutment margins, which would prevent the biologic creation of the connective tissue contact and epithelial attachment.

- Support of the peri-implant mucosa. The transmucosal component of the provisional restoration should support and shape the peri-implant mucosa. Unlike in late implant placement, where the mucosa needs to be reshaped to recreate a three-dimensional, natural looking cuff, in immediate implantation the aim is to preserve and sometimes to enhance the pre-existing contour of the gingiva surrounding the extracted tooth. Thus the prosthetic strategies are completely different, depending on the situation of the peri-implant soft tissue envelope.

This chapter discusses only those strategies to preserve and enhance an existing natural gingival architecture immediately after the removal of a tooth; the different strategies for developing a natural looking mucosa in the case of late implant placement will not to be discussed.

Occlusal and interarch positioning of the provisional crown

An immediate provisional crown needs to be out of any occlusal contact in order to avoid excessive loading during the biologic healing and maturation of the bone and therefore ensure successful osseointegration. In cases where the extracted tooth has an intact crown, the natural tooth can be sectioned at the cementoenamel junction (CEJ), the crown hollowed out, and the natural crown shell utilized as the provisional restoration. In this case, a prefabricated abutment should be attached to the implant head.

It is accepted that the fewer times an abutment is removed and re-engaged to the implant, the more stable the peri-implant tissues will be. Hence, the concept of “one abutment, one time” is the ideal scenario. For this, either a perfectly matched titanium or zirconia prefabricated abutment should be selected, or a CAD/CAM prefabricated titanium or zirconia abutment should be designed and fabricated using a complete virtual design of the implant positioning and the resultant design of the abutment architecture. In either case, once such an abutment is connected to the freshly place implant, it will be necessary to make minor intraoral modifications of the abutment margins at the time of connection, and sometimes later on also, after tissue maturation as well as tightening the abutment to the recommended torque after osseointegration. The transmucosal contours of such an abutment need to support the pre-existing architecture of the gingiva, and the margins should follow the free gingival margins and papillae slightly subgingivally (0.5 to 1 mm), a little bit deeper on the facial aspect.

After engaging the abutment with the implant head, the screw access hole is sealed. The provisional crown is lined with fresh acrylic resin or resin composite and placed over the abutment, with no occlusal contacts against the opposing dentition and with stable interproximal contacts with the adjacent teeth. The crown is then removed, finished, and polished in the traditional prosthetic sequence. In cases of anterior implantation in a tight occlusal bite, there might be a need to transitionally open the vertical dimension of the occlusion. This can be done in a number of ways, such as with resin composite occlusal stops on the supporting cusps of the posterior teeth or with a removable appliance.

Apical engagement to the implant

It should be noted that – depending on the implant connection system used and the manufacturer’s recommendations – an abutment that was placed using a low initial torque may have to be tightened prior to the connection of the definitive crown.

In cases where the immediately placed abutment is not to be the definitive one and is to be replaced, it is possible to utilize a prefabricated narrow abutment. The narrow abutment will not support the gingival contour completely, but will carry a provisional crown that has a submergence profile designed and adapted to support the gingival envelope. The provisional abutments presently used in these cases are made of titanium or polyetheretherketone (PEEK).

Regardless of which strategy is used for immediately cemented provisional crowns, particular care should be taken to ensure there are no cement remnants beyond the crown margins. A venting hole is recommended as part of the cementation protocol.

In cases where the immediate abutment is designed to be the definitive one, it is recommended that an impression of the abutment is made extraorally after modifying the abutment intraorally but before cementation of the provisional crown. This can be done either by digital scanning or by dipping the abutment into a freshly mixed silicone putty with a small hole filled with a light-body silicone paste. The impression will allow the later fabrication of the definitive crown.
coping, which will be sited on the abutment and picked up easily after maturation of the tissues some months later on. This procedure (extraoral abutment impression) can also be utilized in cases where further marginal modification is needed. Otherwise, a traditional soft-tissue deflection technique using a retraction cord followed by digital or elastomeric material impression can be performed.

The transmucosal component of the provisional restoration

In cases where the pre-existing gingival architecture surrounding the extracted tooth is to be preserved, the volume and shape of the prosthetic elements from the implant head up to the free gingival margin and papilla peaks should be designed and created to fill and support the pre-existing gingival cuff. It should be noted, however, that in the anterior maxilla – and in any restoration of high esthetic demand – it is recommended that the buccal mucosa is thickened using a connective tissue graft to reduce or prevent future recession of the thin labial mucosa. To allow placement of the buccal connective tissue graft, in most cases the buccal aspect of the abutment (from one papilla to the other) needs to be slightly reduced in volume to accommodate the thickness of the graft without excessive pressure impinging on it.

As mentioned above, the drawback of applying cement over an immediately placed abutment is the possible entrapment of excess cement, with the obvious detrimental consequences. To avoid this situation, another provisionalization strategy is recommended and widely used: screw-retained immediate provisional restoration.

In this case, the future definitive restoration might be chosen to be either screw-retained or cemented over an abutment, but either way the removal of the provisional restoration and removal and replacement of abutments will be required. However, these steps of connecting and unscrewing must be kept to a minimum to reduce the risk of tissue recession, which is a potential drawback of this strategy.

The most popular way to produce a screw-retained provisional restoration is by connecting a transmucosal cylinder (titanium or PEEK) either to a multi-unit intermediate screwed abutment or directly to the implant head, to be used as the central pillar of the acrylic resin or resin composite crown. (If the extracted tooth has an intact crown, it can be cut from the root, hollowed out and utilized as the shell for the provisional crown restoration.) This cylinder needs to be shortened to below or level with the occlusal height of the sited provisional crown. Its screw hole is to be sealed after connection. The crown shell is perforated to allow it to sit in the desired position, and is checked to ensure it can be easily placed on the connected pillar while also allowing the orifice of the cylinder to be accessed easily. The provisional shell is partly filled with acrylic resin, on its inner occlusal part only, and is positioned over the cylinder in its designed location. Before the acrylic resin sets, it is necessary to remove any material blocking access to the cylinder hole. The screwdriver is then inserted, engaging the screw head. After polymerization of the fresh resin, the crown and cylinder, which are now connected, are removed. At this stage the cervical aspect of the crown is not yet filled. This is done extraorally, by adding fresh acrylic resin or flowable light-cured resin composite to fill the cervical gap between the crown contour and the central cylinder. After polymerization of the material, the crown is contoured to the desired shape, finished, and polished. It is now ready to be screw retained over the implant or intermediate multi-unit abutment. The transmucosal shape of the crown is designed with the same requirements as were described for an immediate abutment connection with a cemented provisional crown.

Cases

The three cases illustrated in the following figures present examples of the different treatment strategies described above: Case 1 from Fig 8-1 to 8-12, case 2 from Fig 8-13 to 8-47, case 3 from Fig 8-48 to 8-57.
Case 1 – A single immediate implant placement with a cemented provisional crown

**Fig 8-1** (a, b) A 25-year-old female presented with internal root resorption on the right central incisor. On probing, bleeding was present on the mesial aspect. The patient exhibited a very thin gingival biotype and a moderate to high smile line with full exposure of the dentogingival complex and surrounding soft tissues. The proposed treatment plan involved extraction of the right central incisor followed by immediate implant placement and respective provisionalization for subsequent prosthetic replacement. This case highlights the surgical details and the importance of the concept of provisionalization.

**Fig 8-2** (a, b) After atraumatic extraction, the implant (Nobel Active RP, Nobel Biocare, Switzerland) was placed by engaging the palatal bone of the extraction socket to obtain primary stabilization and avoiding contact of the facial bone plate, allowing a 2-mm gap for the grafting procedure (Bio-Oss, Geistlich, Switzerland).

**Fig 8-3** (a to c) After implant placement, a Procera Zirconia RP prefabricated esthetic abutment (Nobel Biocare) was selected. Since the implant was placed 3 mm apically to the marginal soft tissue level, a respective collar height was selected for the abutment. The abutment form and buccal will be adjusted according to the final tooth form and allowing for occlusal clearance, using a chamfer shaped diamond bur and water spray.

**Fig 8-4** In this particular case, the extracted tooth could be used as the provisional crown. (a, b) After cutting the clinical crown from the root at the CEJ level, the internal structure was removed and only a shell was left. After placement of PTFE (plumber’s tape) protection on top of the screw access hole, the crown shell was lined with resin in the middle and incisal thirds. A vent hole in the palatal aspect of the crown reduced the possibility of resin entrapment under the abutment concavity or in the extraction socket. After initial setting of the resin, the crown and abutment were removed and the final adjustments were made extraorally. This allowed for a precise fit and, ultimately, better soft tissue healing. Care had to be taken to clean both the abutment and the crown in ethanol in an ultrasonic bath and to irrigate with sterile saline before final placement. This allowed for a biological interface and eventual epithelial cellular adhesion on the biocompatible zirconia abutment surface. The slightly concave transmucosal abutment design and the platform shifting feature of this implant system allow for a suitable volume of connective tissue thickness in the transmucosal zone. Combining these features with connective tissue grafting will create the desired long-term stability at the crown–soft tissue interface. Excessive prosthetic marginal soft tissue pressure at the abutment–crown interface must be avoided at this stage. (c) In most anterior implant restorations, the provisional and final crown will have a negative profile in the most apical part of the restoration. This will allow for ideal soft tissue positioning. The authors strongly believe that both prosthodontist and laboratory technician should understand the impact of soft tissue contouring and prosthetic support on the stability of the soft tissue.
Fig 8-5 Before final placement of the abutment and crown, a connective tissue graft was adapted into a buccal split-thickness pouch.

Fig 8-6 The graft was secured with a suture in the most apical part of the pouch and, after placement of a cover screw, the buccal gap between facial bone plate and implant was grafted with a xenograft (Bio-Oss). The placement of the connective tissue graft combined with a slow absorbable filler material allows for partial compensation of the crestal bone resorption that occurs after extraction.

Fig 8-7 The zirconia abutment was connected (a) and the provisional crown was cemented with provisional cement (b). The aim was to use this abutment as the final abutment and therefore care was taken to avoid the need to unscrew it during the treatment.

Fig 8-8 The provisional crown after 3 months – healing was uneventful.

Fig 8-9 After 4 months the provisional crown was removed and final preparation was initiated. Care was taken to place a retraction cord to protect the fragile transmucosal zone. From this point, the objective was to mimic the preparation configuration of a natural tooth, with the abutment margin being positioned in the gingival sulcus. An impression was taken and models were poured.

Fig 8-10 The master cast represents a perfect replica of the existing clinical situation.

Fig 8-11 A Procera alumina coping (Nobel Biocare) was fabricated – the dental technician artistically mimicked the contour and shade of the natural tooth (ceramist: Murilio Calgaro, Brazil).

Fig 8-12 The 3-year postoperative radiograph shows a stable bone level. The long-term soft tissue stability is excellent. The minimally invasive surgical procedure together with the selection of a proper implant system and appropriate prosthetic design have improved the soft tissue thickness and quality and promoted optimal functional and esthetic results.
Case 2 – Two single immediate implants with screw retained provisional crowns

**Fig 8-13** The preoperative radiographs for this case show, in the right central incisor, a significant reduction of tooth structure and an inappropriate post into the root. There is also a substantial reduction of the periodontal support around the left lateral incisor.

**Fig 8-14** The preoperative clinical edge-to-edge view shows the presence of the two provisional restorations on the right central incisor and the left lateral incisor. The gingival outline shows the lateral incisors in a more apical position than the central incisors and canines.

**Fig 8-15** After removal of the provisional restorations and post, the margin of the right central incisor appears located deeply in the subgingival area.

**Fig 8-16** After atraumatic extraction and 3D socket evaluation, connective tissue grafts were harvested from the palatal region. Placement of the graft in a buccal split-thickness pouch, combined with the use of a filler material (Bio-Oss), will partially compensate for the bone resorption that will occur after extraction.

**Fig 8-17** A Nobel Active RP (Nobel Biocare) implant was placed in the right central incisor position and a Nobel Active NP implant (Nobel Biocare) in the left lateral incisor position. Care was taken to engage with the palatal wall of the extraction sockets, in order to obtain primary implant stability.

**Fig 8-18 (a, b)** After implant placement, the provisional pillar titanium abutments were positioned and cut buccally before inserting the acrylic shells.
Once the pillars have been cut the shells can be placed in position.

Fig 8-19

The shells are placed over the titanium pillars prior to being fixed in the proper position.

Fig 8-20

A flowable composite resin is then applied to fill the gap and create an ideal submergence profile. The light-curing resin composite enables an easy and very quick procedure for construction of provisional crowns.

Fig 8-21 (a, b)

The shells are placed over the titanium pillars prior to being fixed in the proper position.

Fig 8-20

The two provisionals in place after suturing. The two incisal openings highlight the slight oblique orientation of the two implants. Note the gingival level of the right central incisor, which is more coronal than for the contralateral tooth.

Fig 8-22

The final shape of the two provisionals was achieved by the application of the resin composite material. The two restorations were shortened incisally to avoid any contact during excursive movements – this is a fundamental requisite for immediate function.

Fig 8-23

(a, b) After initial healing and osseointegration of the implants, a connective tissue graft was placed on the buccal aspect of the right lateral incisor. The combination of coronal relocation of the tooth preparation and reshaping of the root surface by creating a moderate buccal concavity apically to the preparation (in the dentogingival sulcus) resulted in an increase of connective tissue thickness and coronal relocation of the gingival margin. The soft tissue thickness also concealed the discoloration of the root and created a stable gingival position.

Fig 8-24 (a, b)

After a few months the provisional restoration of the central incisor was removed to idealize the final gingival contour.

Fig 8-25
Fig 8-26 (a, b) A flowable composite was added to push the gingival level apically. The flowable composite was then light cured.

Fig 8-27 Once polymerized, the restoration was inserted into position and reshaped using a bur directly in the mouth.

Fig 8-28 The appropriateness of the gingival outline was then checked.

Fig 8-29 (a, b) The procedure was repeated until acceptable symmetry of the gingival margins of the two central incisors were achieved.

Fig 8-30 The provisional restorations now appear more esthetically adequate, both in the incisal and cervical areas.

Fig 8-31 The ideal shape and contour of the submergence profile were duplicated.

Fig 8-32 Healing abutments were placed during the duplication procedure.

Fig 8-33 Zirconia abutments were relined in the marginal area using a compatible porcelain. Note the concave profile under the margins, especially in the buccal area, which will ensure the presence of a tighter soft tissue.
Restorative options

Fig 8-34 The new provisionals on the plaster model.

Fig 8-35 Once positioned in the mouth the provisional restorations appear well integrated both esthetically and functionally.

Fig 8-36 The two zirconia abutments on implants and the natural abutment built up with a composite on the right lateral incisor are ready to receive the final restorations.

Fig 8-37 The first cords are inserted into the sulcus, before taking the impression the natural central incisor was prepared for a PLV restoration.

Fig 8-38 The second cords will be removed immediately before impression taking.

Fig 8-39 One month after impression taking the patient is back to the office for a review. The provisionals look to be very well integrated, both esthetically and biologically.
Three crowns and one veneer were fabricated in lithium disilicate pressed bi-layered ceramic material.

The palatal view clearly shows the veneer on the left central incisor.

The color and shape of the restorations were extensively discussed with the patient during the treatment.

After cementation of the lithium disilicate restorations, the final esthetic result shows much better harmony in both the incisal and cervical outlines.

The post-treatment radiographs show a perfect integration of the fixtures after 12 months in service.
Fig 8-45 The final occlusal relationship appears adequate.

Fig 8-46 (a,b) The lateral views emphasize the dominance of the central incisors and show the significant improvement of the gingival outline.

Fig 8-47 The new smile shows a harmonious integration of the restorations, with improved dental proportions and an appropriate incisal edge position. (With thanks to ceramists Murillo Calgaro and Dr. Christian Coachman, Brazil).
Case 3 – One single central incisor with two screw retained prosthetic components

Fig 8-48 In this case, a crown of a right central incisor was broken deep under the gingiva. The tooth is unrestorable. The left central and lateral incisors restorations will be replaced as well, due to esthetic reasons (a, b).

Fig 8-49 The root was delicately separated from the periodontium using periotomes, (a) and removed very slowly with a Benex extractor (Helmut Zepf Medizintechnik, Seitingen, Germany), (b) while the gingival envelope was left untouched.

Fig 8-50 After a narrow 2 mm osteotomy was performed at the palatal wall of the socket, manual screw type osteotomes (Prof. Palti, Osteotomes kit, H. Zepf) were screwed into the osteotomy. The first osteotome enlarged it to 2.7 mm, followed by a larger osteotome that enlarged the osteotomy to 3.5 mm. While the second osteotome was in place, a xenograft (Bio-oss) was packed around it (a) to preserve the external bone volume. The osteotome was then unscrewed out, leaving the site prepared (b) for implant placement (c) (Paltop Advanced, Paltop, Caesarea, Israel).

Fig 8-51 After final implant positioning, a concave multi-unit abutment (CCMUA) (Paltop) 2 mm in height was connected to the implant head. This concave transmucosal abutment allows for a tighter adaptation of the tissue, with an extra tissue volume surrounding it (a to c).

Fig 8-52 A titanium sleeve was cut extra-orally to the desired length and screwed to the CCMUA (a). Illustration (b) depicts the implant and the two screw retained prosthetic elements of the restoration.
Fig 8-53 Three pre-fabricated connected acrylic shell crowns were loaded up with fresh acrylic resin. At the implant restoration, the acrylic was placed only at the coronal part of the titanium sleeve and coronal the inner part of the crown, to avoid contact with the fresh surgical wound (a). After acrylic setting (b), the screw of the titanium sleeve was released and the provisional crowns were removed for extra-oral finishing. The titanium sleeve became the central pillar of the implant crown.

Fig 8-54 The gap between the titanium sleeve and the surrounding acrylic was filled extra-orally (a), checked intra-orally (b) and the crowns were then separated, finished and polished extra-orally. The base of the implant crown is (c) hollowed to allow maturation of the connective tissue graft to be placed, without pressure.

Fig 8-55 A connective tissue graft (CTG) was harvested from the palate (a to c).

Fig 8-56 After de-epithelization and pouching, the CTG was secured in place (a and b) (nylon 6.0), the implant crown was screwed to the CCMUA and the provisional crowns on the left central and lateral incisors were provisionally cemented (c).

Fig 8-57 Three months post-surgery, clinical and radiographic images depict uneventful healing (a, b).
References


Suggested further reading


