Multidisciplinary Dental Aesthetics:
A Blend of Artistry And Technology

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Current cosmetic dentistry is not limited to tooth manipulation. To achieve "true" aesthetics, cosmetic dentists must not overlook the importance of the gingival environment. The purpose of this presentation is to review new technology and several techniques where gingival manipulation provides added aesthetics to cosmetic treatment. This includes the use of ovate pontic design to create "lifelike" pontics, as well as manipulation of the tooth-periodontal interface using laser technology to reposition teeth.

The days of cosmetic and aesthetic dentistry being confined to only the hard structures (ie, teeth) are long gone. To maximize the results of aesthetic dental treatment fully, clinicians must have the ability to manipulate the gingival environment predictably. Advances in material science and technologies enable the clinician to enhance aesthetic outcomes by not only controlling tooth morphology and color, but also by allowing the manipulation of the periodontal-restorative interface with a level of finesse never before possible. Even in some cases where minor gingival level corrections are required, the restorative dentist can perform these combined aesthetic treatments without dependence on specialists.

Techniques to preserve the alveolar ridge height following tooth extraction and the use of ovate pontic design to create "lifelike" pontics that emerge from the gingival tissues will be discussed within this article. Also, manipulation of the tooth-periodontal interface using laser technology to reposition teeth spatially in the aesthetic zone will give the clinician and patient, in select cases, a less invasive option to a more traditional orthodontic-orthognathic treatment approach. These tissue management techniques can also make the use of dental implants in the maxillary anterior region more aesthetic and have a more predictable outcome.

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FIGURE 1. Preoperative retracted view of a patient that has a root fracture on tooth #7. Note the square shape of the maxillary anterior teeth.

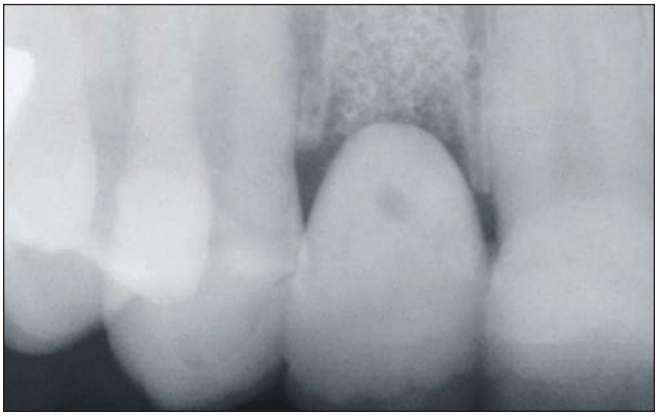

FIGURE 2. Radiograph shows the extraction socket of tooth #7 filled with bone grafting material and the ovate pontic of the provisional restoration. The interproximal bone height and facial plate have been preserved.

FIGURE 3. Retracted view of the completed case. The cervicoincisal heights, gingival zeniths, and width-to-length ratios of the maxillary anterior teeth have been corrected.

FIGURE 4. Preoperative smile view of a patient who requires extraction of tooth #9 due to failing apical surgery.

OVATE PONTICS AND RIDGE PRESERVATION

True dental aesthetics is derived from a delicate balance of the morphology and color of the dentition, silhouetted against the backdrop of a healthy periodontium in a functionally sound occlusion. If one or several teeth are missing, however, a major challenge arises for the restorative dentist to reconstruct these natural biologic parameters. Whichever route is chosen to restore a missing tooth, the key to aesthetic success lies in the preservation of facial and interproximal alveolar bone and symmetry of the soft tissue envelope that surrounds and frames the teeth. Only then can the contours and color of the dental units be exploited to create a maximal aesthetic dental reconstruction.

In the following case, hard and soft tissue dental lasers and synthetic bone grafting material are used to create an aesthetic periodontal environment for the replacement of porcelain laminate veneers and an all-ceramic fixed partial denture (FPD) for a patient with a root fracture and resultant loss of the maxillary right lateral incisor (Figure 1). Although there is adequate space for a dental implant to replace the lost tooth, the patient elects to have a three-unit FPD placed instead.

Given that the patient is 28 years of age, it is imperative to think about preserving the alveolar ridge for long-term aesthetics. One of the advantages of implant placement is that the alveolar ridge will be preserved for

FIGURE 5. An Erbium laser is used to sculpt the soft tissue of the peri-implant area to simulate natural gingival contours.

FIGURE 6. Full-smile view of the completed case after implant placement and completion of the ceramic reconstruction. Note how gingival symmetry and proper tooth proportions make this completed case spectacular.

the patient. In lieu of implant placement, bone grafting helps preserve not only the interproximal alveolar ridge height that is critical for papillae retention, but also the facial contour in the edentulous area. The surgical plan involves a traumatic extraction of the maxillary right lateral incisor by carefully luxating the tooth toward the palatal aspect. Once the extraction site is filled with the bone grafting material, a provisional restoration with an ovate pontic design will form a primary closure over the surgical site, retaining the grafting material and helping to support the periodontal tissues during the healing phase of treatment.

FIGURE 7. Preoperative view of this Class II, Division II patient reveals "square" veneers on the maxillary central incisors and excessive gingival display with unaesthetic gingival levels.

SURGICAL PHASE

After placement of local anesthesia, the porcelain laminate veneers on the teeth adjacent to tooth #7 are prepared using a thin, coarse tapered diamond (Brasseler, Savannah, GA). The preparations are extended interproximally and to the lingual (palatal) aspect to become full-coverage abutments for the three-unit FPD. The treatment plan calls for a three-unit pressed ceramic FPD, therefore, 1 mm to 2 mm of circumferential reduction is needed to create space for the restorative material.

Once the preparations are complete, a "trap-door" designed, full-thickness mucoperiosteal flap is raised on the palatal aspect, exposing the alveolar crest. An Erbium hard tissue laser (ie, Waterlase, Biolase, San Clemente, CA) is used to conservatively remove alveolar bone to gain

FIGURE 8. An Erbium laser is used during an "open flap" procedure to adjust the height of the alveolar crest.

FIGURE 9. Full-smile view of the patient after corrective gingival and bony surgery and placement of her definitive ceramic restorations. Tooth proportion and gingival zenith heights are more aesthetic.

FIGURE 10. A full-smile preoperative view of a patient with altered passive eruption and diastemata.

FIGURE 11. Postoperative view of the patient. The gingival display has been lessened apical to tooth #7 through #10, and width-to-length ratios have been improved.

access for a periotome to sever the periodontal ligament fibers. The laser cuts only at the tip, so the maximum amount of interproximal bone is conserved, yet creates sufficient access for periotomes and small elevators.

Once the tooth is loose in the socket, it is elevated *carefully* toward the palatal aspect. The buccal plate is very thin and care is taken not to fracture it during tooth extraction. Care is taken not to compress the facial plate after tooth extraction. The next step is to place the synthetic bone graft material (ie, BioPlant SSD, Kerr/Sybron, Orange, CA) into the extraction site. The tip of the syringe is placed into the extraction site and blood is drawn into it to be mixed with the grafting material. This blood contains progenitor cells that are important in the regeneration of bone in the socket. The mixture is then syringed into the extraction site to the crest of the bone.

A provisional restoration is fabricated from a preoperative model and an ovate pontic is created that extends 2 mm to 3 mm into the extraction site. The bottom of the pontic is shaped similar to the large end of an egg, which helps support the papillary and marginal gingiva in their preextraction positions by exerting horizontal pressure below the crest of the gingival tissues (Figure 2). The interproximal bone has been maintained and the ovate pontic creates primary closure over the extraction site. As the gingival tissues heal, the ovate provisional pontic will appear to emerge from the extraction socket in much the same manner as the original crown. The facial marginal gingiva is supported by the ovate pontic as well as the interproximal gingival papillae.

The periodontal tissues are allowed to mature for a period of 12 to 14 weeks. At that time, the use of an Erbium laser allows minimally invasive gingival and bony surgery to be performed for minor corrections of aesthetic tissue levels without the need for open flap surgery and the extended healing times associated with that procedure. The patient is extremely pleased with her new smile. Tooth proportions and gingival zenith levels are more symmetrical and aesthetically pleasing *and* the pontic of the three-unit FPD (tooth #7) appears to emerge naturally from the alveolar socket (Figure 3).

IMPLANTS IN THE AESTHETIC ZONE

Unlike electrosurgery, the use of an Erbium laser is safe around metallic surfaces such as dental implants and prosthetic parts (ie, healing abutments) or metal restorative materials. When removable "flippers" (ie, temporaries) are used as interim restorations for implants, gingival hypertrophy may occur from contact with the restoration, even when the restorations are adjusted to avoid implant contact. An Erbium laser can be used in these instances to remove redundant tissue around implant components without the danger of altering the titanium surfaces or interfering with the osseointegration process. "Ovate pontic-like" sites can be created circumferentially around an implant healing abutment to help develop proper emergence profiles to the implant restorations. This will allow the laboratory to create a restoration that aesthetically supports the marginal gingival tissues (Figures 4 through 6).

RECONTOURING OF GINGIVAL TISSUES AND ALVEOLAR BONE

It is generally perceived that the aesthetic smile may show from 3 mm to 5 mm of gingival display. The height of the gingival tissue over the maxillary central incisors ideally is slightly higher than the tissue over the lateral incisors; the tissue over the canines is higher than both. Also, the gingival display should be symmetrical on both sides of the midline. Many patients exhibit asymmetrical gingival levels, have "gummy smiles" (greater than 3 mm to 5 mm of maxillary gingival display), or both (Figure 7). For these types of patients, surgical correction prior to the placement of aesthetic restorations will lead to a greatly improved aesthetic result. If adequate amounts of free gingiva exist, minor asymmetries can be corrected with gingivoplasty alone.

When planning the surgery, the finished maxillary central incisors should be 10 mm to 12 mm in length. The incisal edges can be shortened when adequate freeway space exists, however, the amount depends on the disclusive pattern of the patient. The shortened incisal edges must still disclude the posterior teeth in all eccentric movements to maintain occlusal harmony. A tissue marker can be used to plan the soft tissue surgery. Following the guidelines for aesthetic tissue levels, the perceived final gingival level is traced creating heights of contour at the distolabial line angles. The Erbium laser is used to remove the gingival tissue and create symmetry following the proposed surgical plan. Next, the preparation margins are adjusted to the new heights of the tissue. Biologic width will be encroached upon, so it is important that the same amount of bone be subsequently removed to recreate normal biologic parameters. An intracellular internal bevel incision is made and a full-thickness mucoperiosteal flap is elevated using a periosteal elevator.

According to Kois, the soft tissue architecture (gingival crest) should mirror the alveolar crest, which should be located 3 mm apical to the restorative margin. The bony correction is made using an Erbium laser and a 600 μm tip. The laser is set against the side of the root parallel with the long axis of the tooth, ensuring that the root surface is never damaged (Figure 8). Only the alveolar bone will be ablated by the laser-energized water. The root surface is then planed using a back action chisel. The alveolar architecture should now mimic the restorative margin 3 mm apically, allowing for biologic width restoration. The interproximal bone on facial aesthetic correction cases is not altered, and the flap is sutured back using 3-0 silk and an interrupted suture technique (Figure 9). Width-to-length ratios of the maxillary anterior teeth have been improved, and the amount of gingival display has decreased.

CONCLUSION

True aesthetic makeovers must include a proper evaluation of tooth position and symmetrical gingival profiles. In some cases, a maximal aesthetic result can only be achieved if correction of the gingival silhouette is also performed. With today's available technology, the clinician must be able to diagnose and perform these necessary procedures to create total aesthetics for their cosmetic patients (Figures 10 and 11).