Improving implant position

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Since the advent of modern root form osseointegrated implant dentistry in 1982, clinicians have striven for improvements in implant positioning in the esthetic zone to achieve predictable restorative and esthetic results. Years of clinical experience in congruence with controlled clinical studies have helped establish parameters as a guide for these results. Establishing a treatment plan and clinical protocol prior to implant placement is paramount.

Treatment planning traditionally begins with comprehensive medical and dental evaluations, articulated diagnostic casts, radiographs, cone-beam computed tomography (CBCT) scans and a diagnostic wax-up. Patient demands must be taken into consideration prior to surgery, and pre-surgical mockups may be necessary to convey the information to the patient.

The advancement of CBCT technology has led dentistry into a new realm of dimensional accuracy. In combination with the use of a surgical or guided stent, proper 3-D positioning of an implant has led to more accurate clinical results.

The importance of the implant position can be manifested in the four dimensionally sensitive positioning criteria: mesiodistal, labiobuccal and apicocoronal location, as well as implant angulation.1 The ultimate goal is not only to avoid sensitive structures, but to respect the established biological principles to achieve aesthetic results.

Mesiodistal criteria

Correct implant position in a mesiodistal orientation allows the clinician to avoid damaging adjacent critical structures. A minimum distance of 1.5 mm between implant and existing dentition prevents damage to the adjacent teeth and provides proper osseointegration and gingival contours.5 (Fig. 1a). Distances of less than 3 mm between two adjacent implants leads to increased bone loss and can reduce the height of the inter-implant bone crest. A distance of more than 3 mm between two adjacent implants preserves the bone, giving a better chance of proper interproximal papillary height (Fig. 1b).

Labiobuccal criteria

An implant placed too far labially can cause bone dehiscence and gingival recession while an implant placed too far lingually can cause prothetic difficulties. A thickness of 1.8 mm of labial bone is critical in maintaining an implant soft-tissue profile.5 (Fig. 2). Labially oriented implants compromise the subgingival emergence profile development, creating long crowns and misalignment of the collar with respect to the adjacent teeth.5

Apico-coronal criteria

Peri-implant crestal bone stability plays a critical role in the presence of interdental papilla.2 Implants placed too shallow may reveal the metal collar of the implant through the gingiva. Countersinking implants below the level of the crestal bone may give prosthetic advantages but can lead to crestal bone loss.

The ideal solution would be the placement of an implant equicrestal or subcrestal to the ridge. However, the existing microgap at the implant abutment junction leads to bone resorption because of peri-implant inflammation.6 It is suggested an implant collar be located 2 mm apical to the CEJ of an adjacent tooth if no gingival recession is present7 (Fig. 3).

Implant angulation

Implant angulation is particularly important in treatment planning for screw-retained restorations. Implants angled too far labially compromise the placement of the restorative screw while implants angled too far lingually can result in unhygienic and esthetic prosthesis design.

For every millimeter of lingual inclination, the implant should be placed an additional millimeter apically to create an optimal emergence profile.8 In general, implant angulation should mimic angulation of adjacent teeth (Fig. 4). Furthermore, maxillary anterior regions require a subtle palatal angulation to increase labial soft-tissue bulk.9

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