

Dental Implant Treatment Planning and Restorative Considerations: The Aesthetic Zone

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Treatment Planning and Clinical Considerations: Partially Edentulous

Questions that the dentist needs to consider when evaluating the new patient for dental implant therapy:

- \$ patient expectations?
- \$ medical history?
- \$ presence or absence of adjacent teeth?
- \$ aesthetic zone verses posterior?
- \$ tissue biotypes: high, normal or low crest?
- \$ soft-tissue augmentation?
- \$ non-restorable teeth: immediate or delayed implant placement?
- \$ long-standing partially edentulous anterior condition: site preparation - boney and/or soft tissue augmentation?
- \$ surgical guide/emmergence profile?
- \$ implant design?
- \$ implant placement: vertical, horizontal, implant spacing and number?
- \$ biologic width/height?
- \$ platform switching?
- \$ abutment selection?
- \$ provisionalization?
- \$ occlusion?
- \$ screw or cement retained?

Determine the Patient Expectations

Partially edentulous Key Factors:

- \$ Aesthetics.
- \$ Functional Demands.
- \$ Financial commitment: building perceived value! People typically buy things that they want...not always what they need.
- \$ Treatment phase/time frames:
 - Discuss the number of appointments.
 - Discuss healing time in different areas of the mouth.
 - Total treatment time depends on the type of restoration; adjunctive procedures; and laboratory time needed.

Completely Edentulous Key Factors:

- \$ Functional demands: is minimal movement of their denture Okay (tissue

supported implant retained overdenture therapy), or are they expecting the new overdenture to be very stable (multiple implants for implant supported and retained overdenture therapy)?

- \$ Oral hygiene.
- \$ Financial commitment.
- \$ Treatment phases/time frame.
- \$ Aesthetics.
- \$ Phonetics.

Health History Contraindications:

- \$ Immunosuppression (chemotherapy, HIV, etc).
- \$ Antimetabolic treatment.
- \$ Poorly controlled diabetes.
- \$ Poorly controlled cardiovascular problems.
- \$ Active pharmacodependency.
- \$ Psychiatric disorders.
- \$ Bisphosphonates-intravenous: contraindicated.
- \$ Bisphosphonates-oral: informed consent.
- \$ Smoking: informed consent.

Implant Placement for the Partially Edentulous Patient

Available Bone:

- \$ Minimum implant length 10 mm.
- \$ Ideal length: 13 mm.
- \$ Maximum length: 15 mm.

Bone Quality:

- \$ Type I/II - Mandibular anterior and posterior sites. Require minimum of 1-2 mm of bone surrounding the dental implant.
- \$ Type III/IV - Maxillary anterior and posterior sites. Require minimum of 1.5 to 2 mm of surrounding the dental implant.

Vertical Placement:

- \$ Measured from the *mid-facial free gingival margin of the future restoration*: surgical guides critical to provide the surgical team member this information, including representation of the facial and incisal aspects of the future restoration.
- \$ Implant platform distance to the mid-facial free gingival margin in the Maxillary aesthetic zone:
 - External hex implants: 3 mm (2-3 mm range).
 - Internal hex/lobe implants: 3 mm (2-3 mm range).
 - Conventional morse-taper implants with a 1.8 mm machined collar: 2-2.5 mm (this design is less than ideal for the aesthetic zone).
 - Narrow diameter (3.3-3.5 mm diameter) implants: 3 to 3.5 mm.

Implant-to-Implant Spacing: 3 to 4 mm. In 8 and 9 sites, minimum 4 to 5 mm.

Implant-to-Tooth Spacing: 1.5 to 2 mm.

Facial-Lingual Position:

§ Anterior zone: implant long-axis/screw-access chamber to exit the cingulum area.

§ Posterior zone: center of occlusal table.

Rotational Position:

Flat of the hex and/or lobe facing facial (tangent to the curvature of the arch), in order to take advantage of pre-manufactured contoured abutments and components.

Surgical Guides:

§ Occlusal splint (bruxism splint) design, with future tooth form present: CEJ, facial contour and incisal edge reproduced.

§ Radiographic markers - for example: 5 mm brass tubes - 1/8 o.d. x .014 wall x 12" long, K&S Metals (ksmetals.com). These tubes accommodate up to a 2 mm surgical twist drill.

§ Radiographic marker position verified with conventional 2 dimensional radiographs followed by 3-D computer tomography.

Implant Biomechanics

§ Dental implants tolerate vertical forces well. Lateral forces increase the stress/strain levels at the bone implant interface (exponentially) when compared with vertical loading. Consequently, lateral (oblique/bending moments) forces should be minimized and/or avoided.

§ Wider implants provide for increased bone-implant surface area and therefore improved biomechanical advantage, however, in the anterior zone, wider implants may compromise the mesial-distal restorative emergence profile. Consequently, regular (average of 4-4.3 mm) and small (average of 3.5 mm) diameter implants are preferred.

§ Implant Width:

- Select an implant which is within 1-2 mm of the size of the restoration at the gingival level.
- Small diameter implants (3.3-3.5 mm): Maxillary laterals and Mandibular incisors.
- Once-piece 3.0 mm diameter implants: lateral incisors, when only 6 mm of inter-root space is present and further orthodontic therapy is contraindicated.
- Regular diameter implants (4.1-4.3 mm): Maxillary centrals, canines and premolars.
- Wide diameter implants (5.0-6.0 mm): Maxillary/Mandibular molars. Maxillary canines in select cases (no greater than 5.0 mm diameter).

§ Splinting Implant Restorations - Indications:

- Grafted sites.

- Compromised crown-to-implant ratio - long clinical crowns (minimum desired crown-to-implant ratio is 1:1).
 - Multiple regular diameter implants in the posterior zone.
 - Implant supported fixed partial dentures.
 - Multiple posterior regular diameter implants: splint together to improve stress-distribution and biomechanical advantage.
 - Narrow implants.
 - Parafunction.
- § Splinting to Natural Teeth:
- Consider the potential cantilevering effects!
 - Avoid when-ever possible.

Implant Site Development

Grafting options:

- § Autogenous bone graft (same species and genotype).
- § Allogenic (same species, different genotype).
- § Xenograft (different species).
- § Alloplast (synthetic).
- § Collagen.
- § PRP - platelet rich plasma.

Orthodontic therapy:

- § Repositioning teeth/roots: require a minimum of 7 mm between roots to accommodate a small diameter root form dental implant.
- § Translation of teeth to generate bone.
- § Forced eruption to verticalize boney defects (adjacent roots):
 - Once desired extrusion levels have been achieved, the teeth will require further stabilization (brackets and arch-wire maintaining teeth in position) for an additional 3 months. This will allow for the newly formed bone to mature. Teeth can then be removed and implants placed immediately or the sites grafted and implant placement delayed.

Presence or Absence of Interproximal Papillae

The presence or absence of interproximal papillae is inversely related to the distance from the base of the contact area to the underlying crest of bone.

- With natural teeth, at a distance of 5 mm or less - papillae is present 100% of the time; at 6 mm - papillae is present 56% of the time; and at 7 mm or more - papillae is present only 27% of the time (Tarnow et al. The effect of distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. J Periodontol 1992;63(12):995-996).
- Between dental implants: "2 to 4 mm (3.4 mm average) of soft-tissue height can be expected to cover the interimplant crest of bone." Tarnow DP et al. Vertical distance from the crest of bone to the height of the

interproximal papilla between adjacent implants. J Periodontol 2003;74:1785-1788.

- Interproximal soft tissue dimensions measured from the most coronal interproximal height of bone (Salama H. et al. Journal of Practical Periodontics):

Restorative Environment	Proximity Limitations	Vertical Soft Tissue Limitations
Tooth - Tooth	1 mm	5 mm
Tooth - Pontic	N/A	6.5 mm
Tooth - Implant	1.5 mm	4.5 mm
Implant - Pontic	N/A	5.5 mm
Implant - Implant	3 mm	3.5 mm
Pontic - Pontic	N/A	6 mm

Number of Implants:

- § Will depend on bone quality, biomechanical factors and aesthetic considerations.
- § Anterior zone (5-12 region - type III bone): Implant-Pontic-Implant or Implant-Pontic-Pontic-Implant. Avoid adjacent implants.
- § If 8 and 9 are missing, need to provide a minimum of 4-5 mm of space between the dental implants and also expect a reduced papillary height compared with the original tooth-to-tooth papillary height (average of 1.5 mm papillary height loss following completion of restorations under optimal treatment conditions). Patient expectations must be set/limitations accepted and inter-implant distance available prior to considering this treatment option.
- § Lower Anterior zone (type I bone): Implant-Pontic-Implant or Implant-Pontic-Pontic-Implant.
- § Posterior mandible (type II bone): Implant-Pontic-Implant or Implant per tooth.
- § Posterior Maxilla (type IV bone): Implant per tooth.

Biologic Width Around Implants

Bone level is determined by:

- § Soft tissue thickness of approximately 3mm (1 mm sulcus and 2 mm biologic width).
- § Exposure of the implant-abutment junction to the oral environment.
- § Abutment-implant seal.
- § Implant design: presence of threads and surface topography.
- § Vertical implant placement: location of the implant-abutment junction and of the inflammatory connective tissue infiltrate...emergence profile requirements.

Implant prosthetic connection/design for the anterior zone:

- \$ Internal/external hex implants (with a 1 mm or less machined collar).
- \$ Lobed connection implants (with a 1 mm or less machined collar).
- \$ Indexed friction fit connections (with a 1 mm or less machined collar).
- \$ Conventional morse taper with a 1.8 mm machined finished collar: less than ideal in the aesthetic zone. Appropriate design for the posterior zone.

Prosthetic Abutment Selection

- \$ Conventional Stock Abutments (pre-manufactured).
 - Following preparation - lack of emergence profile under tissue margin; deep margin position and consequently cement removal challengers.
 - Less than ideal abutment choice.
- \$ Custom abutments:
 - Laboratory cast (UCLA).
 - Computer milled (Atlantis, Procera, Encode).
 - Both provide custom subgingival emergence profile and marginal positions. Consequently, often needed and required for the anterior zone restoration.
- \$ Recently available Pre-Contoured Stock Abutments.
 - Anatomical margins follow gingival contours: minimized grinding.
 - Straight and angled abutments.
 - Different marginal heights, profiles and contours available: natural emergence profile below soft-tissue.
 - Titanium and zirconium: documented biocompatibility.
 - Cement or screw-retained.
 - Contra-indications:
 - When implants significantly divergent.
 - If flat of the external/internal hex and/or lobe not tangent to the curvature of the arch (not positioned mid-facial).