Planning for esthetics – Part 1: single tooth bone level implant restorations

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Osseointegrated dental implants have proven successful when supporting restorations treating all forms of edentulism. With this in mind, it remains difficult to clearly define parameters that lead to the successful planning and execution of treatment in the esthetic zone. In most instances this difficulty is caused by a continuing notion that patients seek implants, when in reality they seek replacements for missing teeth. While successful osseointegration remains a key to success, viewing the implant as a component of the prosthesis rather than pre-prosthetic surgery will improve diagnostic and data collection procedures with consequent improvements in the esthetic outcome.

Clearly, improvements in clinical technique (including single-stage implant placement and accelerated loading protocols) in conjunction with implant development (bone-level implant line and the SLActive® surface) have improved the esthetic predictability of implant-based restorations. These advances do not, however, reduce the necessity for detailed evaluation of the patient and appropriate planning for each individual site.

Diagnosis and treatment planning for the proposed implant site is multifactorial. The definitive restoration planned for the space should be the driving force in both data collection and site evaluation (Figure 1). This information can be readily transferred between team members with appropriate template fabrication. Restoration-specific site evaluation will include both hard and soft tissues. The purpose is to determine the necessity for tissue augmentation, the goal of which is ideal placement of an implant capable of supporting and retaining an esthetic and functional restoration.

Hard tissue evaluation should include a two-dimensional radiographic evaluation of bone height and mesio-distal width. Radiographs should include an evaluation of the height of the bone crests on teeth adjacent to edentulous spans (Figure 2). In general, all treatment should be planned to preserve the vertical height of these crests because of their intimate relationship to the presence of papillae.

Clinical evaluation of hard tissues should also determine the facial-palatal dimension of the proposed implant site, and relate this to the planned restoration (Figure 3). It should be noted that residual ridge anatomy is unreliable as an indicator of bone dimension, and clinical procedures (e.g. sounding or CBCT radiography) should be employed, when needed, to accurately map the osseous contours. The volume of bone must enable restoration-driven implant placement into a site conducive to predictable healing and volume maintenance. Of particular importance is the dimension of bone on the facial aspect of the implant with every effort made to maintain a minimum of 1mm horizontal width in this area. This can assist in preventing resorption of bone and subsequent loss of peri-implant tissue support.

The soft tissue evaluation should also be related to the planned restoration. Because we are able to place implants with predictable survival and fabricate esthetic crowns routinely with modern ceramic materials, the true esthetic success of restorations is often related to the mucosal contours and particularly the presence of papillae. Soft

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Figure 1: Pre-operative planning: diagnostic wax-up.

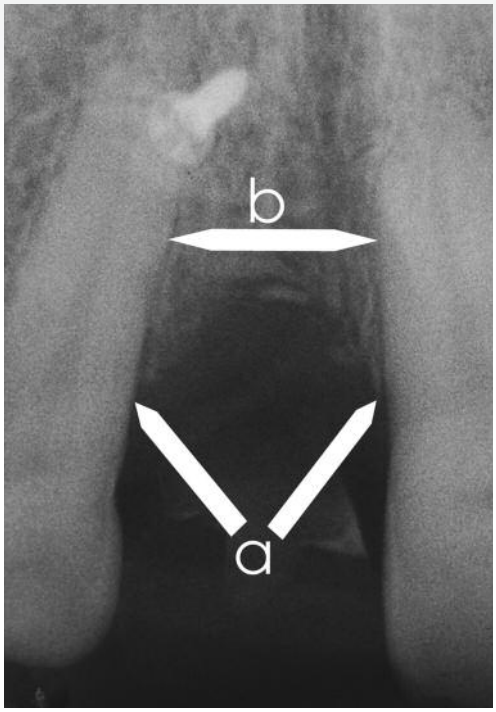

Figure 2: Pre-operative planning: radiographic assessment:
(a) – interproximal crest height,
(b) – interproximal root space.

tissue evaluation begins with the proposed mucosal zenith for the planned restoration (Figure 4). The zenith for individual teeth may be defined for simplicity as the most apical visible point of tooth, and will vary in horizontal and vertical position dependent on the specific site being restored.

Once established, the position of gingival zenith will permit the comprehensive assessment of soft tissues. The thickness and morphology of the mucosal tissues are critical as the type of soft-tissue biotype (thick or thin) may influence the selection of the implant body design (soft-tissue level vs. bone-level) as well as the surgical approach (flapless vs. conventional). The soft-tissue level implant design brings the restorative margin of the implant closest to the free gingival margin in the region of the zenith. The biologic width (being the distance from the free gingival margin to the bone), being comprised of connective tissue, junctional and sulcular epithelium, is at its minimum in this region and planning should assume minimal margin for error. The planned restoration and implant choice should therefore be mindful of this dimension (approximately 3mm) and capable

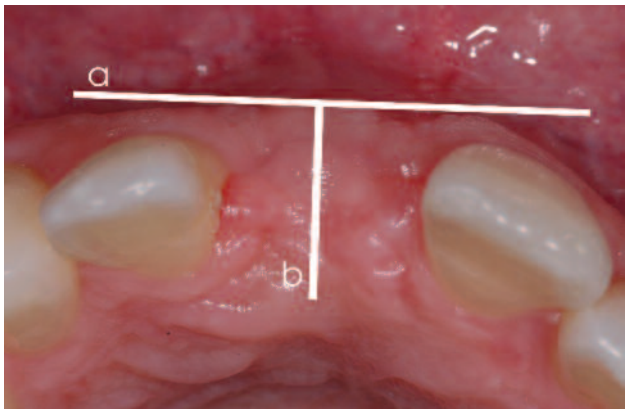

Figure 3: Pre-operative planning: (a) - proposed emergence position, (b) - horizontal width.

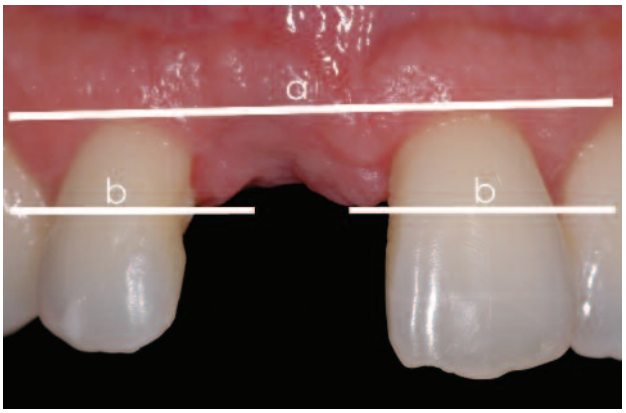

Figure 4: Pre-operative planning: (a) - gingival zenith, (b) – papilla height.

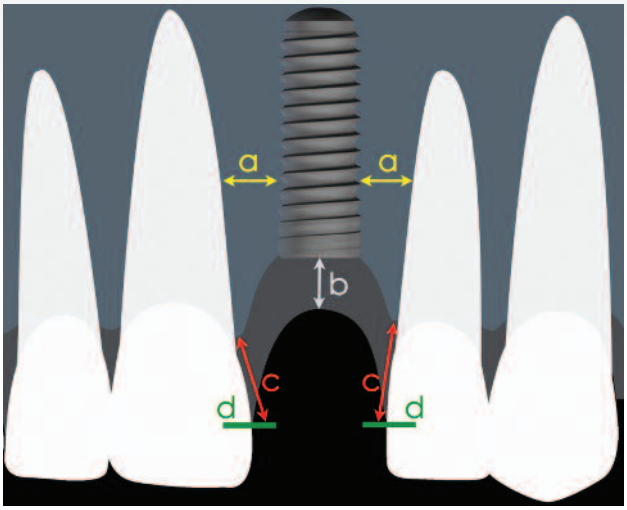

Figure 5: Planning implant placement: (a) – implants positioned at a minimum 1.4mm to adjacent root structure, (b) – vertical depth of implant head 3mm apical to planned mucosal zenith of restoration, (c-d) – interproximal bone crests 5-6mm to contact points.

of preserving it in the long term, which will be more predictable in a thick tissue biotype situation. The bone-level implant design requires the placement of the head of the implant at the osseous crest height or slightly below. Its design is composed of a slight vertical and horizontal offset position of the microgap allowing for maintenance of the osseous crest at this level. One critical factor is related to the emergence of the abutment and restoration off the implant head, which will require the adequate amount of vertical space to allow for generation of the ideal emergence profile of the restoration. The placement of the implant at the bone level results in the soft-tissue transition zone being supported by the restorative material allowing for more control over esthetic outcomes, as needed in thin tissue

Figure 6: Final restoration (3-years).

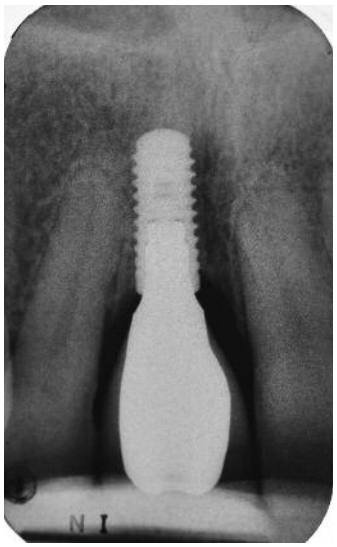

Figure 7: Peri-apical radiograph (3-years).

biotype situations. Violation of this dimension in a vertical nature will lead to a compromise in the esthetic outcome. With this, the implant head should be placed at a minimum of 3mm apical to the planned mucosal zenith. Assessment of proposed implant sites also requires careful attention to adjacent structures, particularly teeth. The horizontal distance between implant surface and the adjacent root should approximate 1.4mm. This dimension will help prevent significant resorption of the bone crests during healing. Lastly, to further enhance the development of gingival papillae, the planned restoration should be related to the anatomy of each individual site. Every effort should be made to plan for implant placement which allows for the contact points between the teeth to be placed within 5-6 mm of the interproximal bone crests (Figure 5).

In the majority of clinical situations, maturation of the peri-implant tissues and support for the papillae is developed through fabrication of provisional restorations that shape and support the tissues in the transition zone (from the head of the implant to the mucosal margins), one key factor critical to esthetic success.

In summary, the implant site should allow for positioning of the implant head of the bone-level implant 3mm apical to the proposed position of the mucosal zenith of the planned restoration, while preserving distances from adjacent tooth structures and proposed contact points (Figures 6-7). This implant position must be accurately described by a series of surgical templates provided to the surgeon if predictable esthetic results are to be achieved. An inability to place the implant according to the plan dictated by the proposed restoration is an indication for site enhancement as the reliability of esthetic restorations fabricated on implants positioned less than ideally is questionable at best.

References

Buser et al. Influence of surface characteristics on bone formation around titanium implants. A histomorphometric study in miniature pigs. J Biomed Mater Res 1991a; 25: 889-902

Buser et al. Soft tissue reactions to non-submerged unloaded titanium implants in beagle dogs. J Periodontol 1992a; 63: 226-236

Buser et al. Long-term evaluation of non-submerged ITI implants. Clin Oral Implant Res 1997; 8: 161-172

Cochran DL et al. Biologic width around titanium implants. A histometric analysis of the implant to-gingival junction around unloaded and loaded non-submerged implants in the canine mandible. J Periodontol 1997; 68: 186-198

Cochran DL. A comparison of endosseous dental implant surfaces. J Periodontol 1999; 70: 1523-1539

Hermann JS et al. Crestal bone changes around titanium implants. A radiographic evaluation of unloaded non-submerged and submerged implants in the canine mandible. J Periodontol 1997; 68: 1117-1130

Higginbottom F., Wilson T. Three-Dimensional Templates for Placement of Root-Form Dental Implants: A Technical Note JOMI Vol.11 No.6 1996

Tarnow DP. Inter-proximal contact points and evidence of black spaces. J Perio 1992

Dr William C Martin will be a keynote speaker at the 2016 ITI National Congress, *"Another Brick in the Wall"*, 16-17th July 2016, Pretoria.