

Soft tissue challenges with dental implants

One of the challenges in the provision of dental implants is the development of soft tissue – the so-called “pink” aesthetics that frame our restoration. Both pink and white aesthetics contribute to provide a smile with harmony and balance. Dr. Pascal Magne states: “A defect in the surrounding tissues cannot be compensated by the quality of the dental restoration and vice versa” (Figure 1, 2 and 3). There are few studies on implant aesthetics and they have reported complications from 4%-16% of single crowns in the anterior maxilla. The most common aesthetic complication is gingival recession, with one study reporting 61% of cases with at least 1mm gingival recession on the facial aspect (Oates et al, 2002).

As the evolution of implant dentistry develops there is an emphasis on aesthetics combined with function, with many restorative dentists now cognisant of the importance of the soft tissue frame around implants, especially in the anterior zone. The restorative and surgical team should work in combination to reproduce natural “pink” and “white” aesthetics for the patient, and when this is not possible this should be discussed beforehand so that there is no disappointment when treatment is completed.



Figure 2: Note severe buccal angulation of fixture.



Figure 1: Patient referred for complication: severe buccal angulation and deep placement leading to loss of buccal soft tissues.



Figure 3: Final restoration (screw retained porcelain metal crown). Note the screw access hole and the severe apical position of the gingival margin due to the poor buccal placement. The result is an aesthetic failure due to the previous poor planning and execution.



Figure 4: Implants placed 3mm apart do not allow bone loss to overlap, while implants placed closer than 3mm together result in overlap and additional loss of crestal bone (from Jiraj S and Chee W, 2006).

Single tooth implants

Optimal implant positioning in relation to the adjacent teeth is an important factor in achieving an aesthetic result. In an apical-coronal position, it is recommended that the implant be positioned 2mm to 3mm below the cemento-enamel junction of adjacent teeth. Buccal-lingually, an implant that is positioned too far to the lingual may result in ridge lapping of the definitive restoration and compromise esthetic results. Likewise, if implants are placed too facially, the tissues will often recede and be too apical.

The ability to form soft tissue papillae around natural teeth has been discussed by Tarnow et al (1992) with the distance between the osseous crest and contact point being the determining factor as to its presence. His research showed that the papillae would be fully present if this distance was 5mm or less, 56% of the time at 6mm distance and 27% at 7mm.

Similarly, the same principles apply with papilla formation between implants and natural teeth. Grunder (2000) presented 10 case reports on single tooth implants and stated that all papilla reformed after the final crowns were placed on the implants. The critical factors were, firstly, the existence of healthy bone on the adjacent tooth, and secondly, the location of this bone at a distance of 5mm or less from the contact point. This was also confirmed by Choquet et al (2001) in a study on single tooth implants.

Adjacent implants

In partially edentulous regions, to recreate natural papillae between adjacent implants has been unpredictable with many different surgical and prosthetic attempts to form this elusive soft tissue.

The biologic width around implants has been well documented in the literature. Once an implant is uncovered, vertical bone loss of 1.5mm to 2mm is evidenced apical

to the newly established implant-abutment interface. Tarnow and coworkers have shown in their research that the crestal bone loss for implants with a greater than 3mm distance between them was 0.45mm, while the implants that had a distance of 3mm or less between them had a crestal bone loss of 1.04mm. Therefore it has been suggested that a distance of 3-4mm is allowed between two implants, otherwise the angular defects, which extend up to 1.5mm appear to cross over creating a horizontal interimplant crestal bone loss (Figure 4).

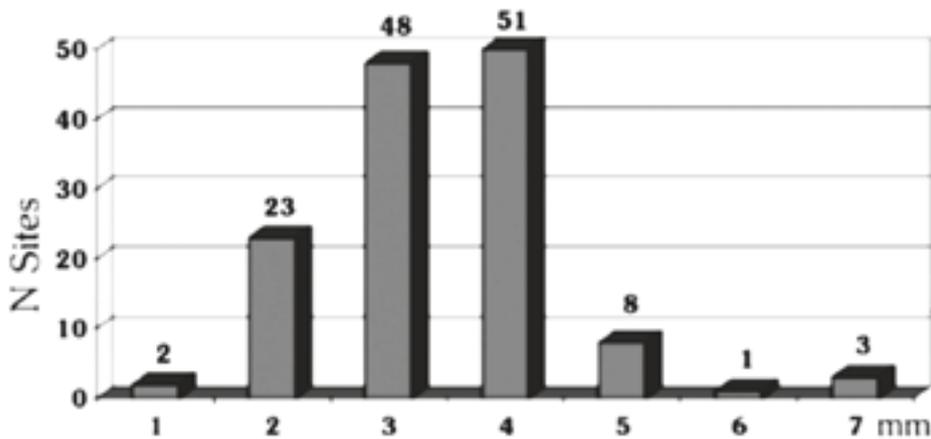
The proximity of two implants being too close to each other also compromises the blood supply to this region, compromising predictability of the peri-implant papilla as well as making it more difficult for hygiene purposes.

The clinical significance of this phenomenon is that the increased crestal bone loss would result in an increase in the distance between the base of the contact point of the adjacent crowns and the crest of bone and therefore no soft tissue papillae. It has been suggested that selective utilization of implants with a smaller diameter at the implant-abutment interface may be beneficial when multiple implants are to be placed in the esthetic zone so that a minimum of 3 mm of bone can be retained between them.

Is there a 5mm vertical (contact point to crest) distance rule for papillae presence between adjacent implants?

In between adjacent implants, the contact points are often arbitrary and often are elongated to minimise the black hole "disease" so it is not possible to correlate this 5mm rule in these cases. Tarnow et al (2003) showed that the amount of soft tissue or papilla vertical thickness between adjacent implants ranged from 1-7mm with the mean thickness being 3.4mm (Figure 5). With such thin tissue thickness in this region, it can be understood why there is often the tissue deficiency in the papillary region between adjacent implants.

Figure 5: The mean height of tissue thickness of papilla between adjacent implants is 3.4mm, and ranged from 1-7mm (Tarnow et al, 2003).



4. Use of final abutments at time of surgery (Figure 6). It has been shown by Abrahamsson et al (1997) that continual removal and connection of abutments results in a more apically positioned connective tissue attachment. Abrahamsson et al (1998) along with Abrahamsson and Cardaropli (2007) have shown soft tissue attachments to the different abutment surfaces from titanium, gold to zirconia and alumina ceramic. It has been postulated that the use of these final abutments at time of implant placement or uncovering will allow soft tissue attachment that will not need to be disturbed, thus allowing a more coronal position which may help with the formation of soft tissue height.

Solutions for soft tissue deficiency between adjacent implants

In the aesthetic zone with multiple adjacent implants, the possible solutions include:

1. Augmentation of the soft and hard tissues prior to placement. Grafting soft and hard tissues, osteogenic distraction or using orthodontic extrusion may be used to achieve overbuilding of the site.
2. Placing a single implant with a cantilever bridge off the implant rather than using two implants adjacent to each other. The cantilever could have a well contoured ovate pontic and the edentulous site may be further improved by connective tissue grafting prior to utilising the ovate pontic.
3. Splinting a natural tooth and implant and using an ovate pontic as a three unit fixed bridge. Rigid connection would be required to avoid intrusion of the natural tooth.



Figure 7: Patient with temporary implant crowns on 21 and 22. At time of implant placement, a connective tissue graft was taken from the palate to thicken the soft tissue biotype and create more soft tissue volume. Note the tissue deficiency still present between 21 and 22.



Figure 6: Procera Esthetic Zirconia abutment placed at time of surgery.



Figure 8: Veneer preparations 11, 12. Procera Zirconia abutments fitted on 21, 22. Note the deficient soft tissue height between the two implants.



Figure 9: Empress Esthetic Veneers for 11, 12 and Emax Press Bridge for 21/22.



Figure 10: Veneers and bridge cemented (day of insertion). Note the use of pink porcelain for the 21/22 bridge. As the tissue matures the soft tissue aesthetics will improve further. Access for hygiene must be made possible to cleanse the area.



Figure 11: Full smile at day of cementation.

5. Papillary Illusion: This may be achieved prosthetically with the use of elongated contact points or the use of “pink” porcelain to give the appearance of soft tissue (Figure 7-11).

Conclusion

The soft tissue profile around implants plays an important role in the ultimate success that the surgical/restorative team and our patients aim for. The importance of optimal positioning of implants through correct treatment planning and execution is an important part of that process. The clinician must understand the possible limitations in recreating papilla between implants and natural teeth as well as with adjacent implants and this must be discussed with patients prior to treatment as to the achievability of success. **DA**

References:

1. Ekfeldt A, Carlsson GE, Borjesson G. Clinical evaluation of single tooth restorations supported by osseointegrated implants. A retrospective study. *Int J Oral Maxillofac Implants.* 1994;9:179-183.
2. Jemt T, Laney WR, Harris D, et al. Osseointegrated implants for single tooth replacement: A 1 year report from a multicenter prospective study. *Int J Oral Maxillofac Implants* 1991;6:29-36.
3. Jivraj S, Chee W. Treatment planning of implants in the aesthetic zone. *Br Dent J* 2006;201(2):77-89.
4. Tarnow D, Manager MW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal papilla. *J Periodontol* 1992;62:995-996.
5. Tarnow DP, Cho SC, Wallace SS. The effect of interimplant distance on the height of inter-implant bone crest. *J Periodontol* 2000;71:546-549.
6. Berglundh T, Lindhe J, Ericsson I, Marinello CP, Liljenberg B, Thomsen P. The soft tissue barrier at implants and teeth. *Clin Oral Implants Res* 1991;2:81-90.28.
7. Grunder U. Stability of the □ 1-17.
8. Choquet V et al. Clinical and radiographic evaluation of the papilla level adjacent to single tooth dental implants. A retrospective study in the maxillary anterior region. *J Periodontol* 2001;72:1364-1371.

About the Author



Dr. Christopher Ho received his Bachelor of Dental Surgery with First Class Honours at the University of Sydney. He has completed postgraduate studies in the Graduate Diploma in Clinical Dentistry in Oral Implants at the University of Sydney, and a Masters of Clinical Dentistry in Prosthodontics with Distinction from Kings College, London.

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