Anterior Implant Cantilevered Restorations

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Two adjacent missing teeth in the anterior maxilla or mandible often pose a challenge for implant reconstruction. Maxillary lateral incisors and all mandibular incisors have relatively small diameters and replacement with two adjacent implants often results in the implants being positioned relatively close together which can compromise an optimal esthetic outcome. When adjacent teeth are extracted, the papilla between those teeth is left without a natural tooth on either side and will typically recede by 1 to 2mm (Spear 2009). When implants are separated by less than 3mm of space, crestal bone loss can affect the height of the inter-implant bone (Tarnow 2000). The consequence of inter-implant bone loss is further loss of the papilla which can compromise esthetics and create food traps or difficult to clean areas. These two factors often lead to esthetic nightmares in anterior cases with adjacent missing teeth.

Standard tooth-based prosthodontic rules have heavily influenced implant-based prosthodontics. Despite initial assumptions, over time it has become apparent that in some ways implants behave differently than teeth. For example, proposed guidelines for acceptable crown-to-root ratios have been adopted by the profession at large as standard factors in determining the success of tooth-based prostheses. However these same crown-to-root ratios do not seem to influence implant survival rates, as reported by Schulte et al. (2007). Another example is cantilevers. Although success rates dwindle with cantilevers in tooth-based prostheses, implants seem to tolerate cantilevers much better (Wennstrom et al. 2004).

The characteristic of implants to withstand force better than natural teeth can be applied in the maxillary or mandibular anterior where a cantilever can be advantageous. With a cantilevered design, not only can we prevent inter-implant bone loss, soft tissue grafting can produce over 6mm of tissue height above the crestal bone (Spear 2009), allowing the creation of an ovate pontic with full papillae. However, we should not be cavalier with designs that increase force production in implant prostheses. In a finite element analysis, Rubo and Souza (2008) demonstrated *in vitro* that implant length, diameter and crown-to-implant ratio have a minor influence on high stress force production but cantilevers can have a major influence. Fortunately, because teeth in the anterior maxilla and mandible are often small, cantilevers can be made relatively short to minimize the increase in force on the prosthesis, implant and bone. Furthermore, the anterior occlusion can be designed to further minimize forces on a cantilever.

Concern of survival and success when force factors such as

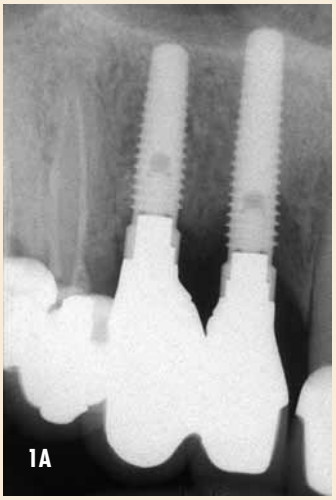

FIGURE 1A. — Implants in the 1.3 and 1.2 area with crestal bone loss. **FIGURE 1B.** — Image of the final prosthesis. Notice the blunted papilla between the implants but not next to the natural teeth.

FIGURE 2A. — Initial image of failing teeth in the 1.2 and 1.1 positions. **FIGURE 2B.** — Implants placed close together in the 1.2 and 1.1 area with a temporary removable prosthesis. Notice the significant reduction in the inter-implant papilla height. **FIGURE 2C.** — Image of the final fixed prosthesis. Notice how the pink porcelain on the prosthesis is only needed in the inter-implant area and not next to the natural teeth where the papilla is relatively maintained.

cantilevers are planned has long been a concern. Clinicians often worry over implant stability, bone loss and recession. Tymstra et al. (2011) recently looked at this issue in the maxillary anterior. Their study is a pilot study, having only 10 subjects and a 1 year follow-up, but is still of interest. Tymstra et al. found no difference between a single implant and two adjacent implants replacing missing adjacent maxillary central and lateral incisors. Halg et al. (2008) did a more thorough study of bone loss and implant survival in cantilevered and non-cantilevered fixed partial dentures and also found no difference.

Most published studies discussing cantilevered implant complications indicate that the major complication found is not with the implants but rather the prosthesis. Zurdo, Romao and Wennstrom (2009) found the 5-year complication free survival rate was 72% for implant supported prostheses with cantilevers compared to 86% without cantilevers. This means 28% of cantilever prostheses had complications after 5 years – double the 14% for non-cantilevered prostheses. The most common complications were screw-loosening and porcelain fracture, both easily attributable to increased force on the prosthesis.

Additionally, the incorporation of a cantilevered pontic does not guarantee optimal esthetic results. Ovate pontics should be formed appropriately, preferably sitting in the gingiva by over 2mm. This depth often requires tissue grafting prior to attempting to create an ovate pontic. If achieved, ovate pontics give the illusion of a tooth naturally emerging from the gingiva. Failure to produce ovate pontics sites can produce esthetic outcomes that are sub-optimal, similar to two adjacent implants.

Most clinicians are concerned with the increased vertical torque

FIGURE 3A. — A single implant has been placed in the 2.1 area to replace both maxillary central incisors. **FIGURE 3B.** — Radiograph of the 2.1 implant with a final prosthesis cantilevered into the 1.1 area. **FIGURE 3C.** — Image of the final prosthesis. A cantilevered ovate pontic on 1.1 helps to create natural looking esthetics. Although the central papilla is blunted, it is still present and the esthetics are good.

FIGURE 4A. — Adjacent implants in the 1.1 and 2.1 areas with a 1.2 cantilever. **FIGURE 4B.** — The 1.1 and 2.1 have a satisfactory outcome despite no papilla between them and the modified ridge lap pontic on 1.2 provides no papilla between 1.2 and 1.1.

FIGURE 5A. — Implant in the 2.3 area with a 2.2 cantilever. A properly contoured ovate pontic space has been developed. **FIGURE 5B.** — The ovate pontic placed in the 2.2 area provides an excellent soft tissue profile and natural-looking esthetics.

on cantilevered prostheses, but there is also increased horizontal torque. With conical implant-to-abutment attachments becoming more popular, it is important to maintain an appropriate rotational resistance in single implant restorations or abutments can rotate and possibly require replacement.

Cantilevered prostheses also have the disadvantage of having a pontic. Pontic areas are prone to bone atrophy over time if the bone under them is not stimulated. Anterior single tooth edentulous sites are relatively small and the bone is usually preserved on the teeth or implants adjacent. However they are still susceptible to vertical and especially horizontal bone loss. The result is often seen as recession or a space opening under the pontic. This bone loss can be reduced by the use of a slowly resorbing bone graft at the time of extraction, such as dense hydroxyapatite or a xenograft. The pontic site can also be treated after resorption has occurred by grafting under a pontic already in place, although without removal of the prosthesis a properly formed ovate pontic cannot be readily achieved. Truly though, stimulating the bone with a loaded implant is the best way to prevent long-term bone atrophy of an edentulous span.

When treatment planning an implant case in the maxillary or mandibular anterior, it is important to consider these factors. Experience has shown us that two adjacent implants in the anterior are often associated with sub-optimal esthetics especially if placed closer than 3mm together. However studies suggest

FIGURE 6A. — Implant in the 1.1 area with a 1.2 cantilever. **FIGURE 6B.** — The esthetics for this patient may have been improved if tissue grafting and ovate pontic preparation were done prior to restoration. As is, the ovate pontic merely sits on top of the edentulous ridge gingiva and a small blunted papilla creates a poor esthetic outcome.

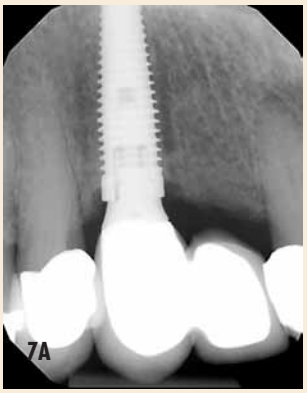

FIGURE 7A. — Implant in the 1.3 area with a 1.2 cantilever. **FIGURE 7B.** — The platform switching did not provide anti-rotational properties and the abutment on 1.3 has rotated causing the 1.2 to drift facially. **FIGURE 7C.** — Occlusal image of the rotation of 1.3 and facial drift of 1.2.

cantilevered prostheses are associated with more mechanical complications than non-cantilevered prostheses and long-term pontic spaces are prone to bone loss. The value of esthetics and function needs to be evaluated in each case by patient preference and factors such as smile lines and gingival biotypes. In the end, a thoughtful situation specific and evidence-based decision should be made for each patient. **OH**

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Oral Health welcomes this original article.

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