Dimensional profile of oral mucosa around combined tooth-implant-supported bridgework in macaque mandible

Key words: abutments, dental implants, histomorphometry, oral mucosa, soft tissues

Abstract
Purpose: A stable oral mucosa is crucial for long-term survival and bio functionality of implants. Most of this evidence is derived from clinical and animal studies based solely on implant-supported prosthesis. Much less is known about the dimensions and relationships of this soft tissue complex investing tooth-implant-supported bridgework (TISB). The aim here was to obtain experimental evidence on the dimensional characteristics of oral mucosa around TISB with two different abutment designs.
Methods: Sixteen 3-unit TISB were constructed bilaterally in the mandible of eight adult Macaca fascicularis. An implant system with a standard progressive thread design was the bone-anchoring implant in the second mandibular molar region while the second mandibular premolar served as the natural tooth abutment. Eight implants were connected with the tapered abutment, the remaining with butt-joint abutment, in a split-mouth design. These were allowed to functional load for 6 months before sacrifice for histomorphometry. Six soft tissue indices were scored: coronal gingival mucosa-to-implant top distance (DIM); sulcus depth (SD); junctional epithelium (JE); connective tissue contact (CTC); implant top to first bone-to-implant contact distance (DBI); and biologic width (BW = SD + JE + CTC); corresponding parameters in the natural tooth abutment were also measured.
Results: Mucosal dimensions in tapered implants (BW = 3.33 ± 0.43; SD = 1.03 ± 0.24; JE = 1.08 ± 0.13; CTC = 1.22 ± 0.23 mm) were comparable with those of natural tooth abutments (BW = 3.04 ± 0.18; SD = 0.93 ± 0.1; JE = 0.78 ± 0.1; Attachment = 1.33 ± 0.09 mm), but differed from butt-joint implants (BW = 4.88 ± 1.24; SD = 1.47 ± 0.38; JE = 1.49 ± 0.4; CTC = 1.92 ± 0.93 mm) (*P<0.05).
Conclusions: Results suggested that soft tissue dimensions around TISB are influenced by the implant-abutment interface and abutment material used. Mucosa investing tapered abutment tends to recapitulate soft tissue physiologic dimensions of natural tooth.

Amongst the various implant therapeutic armamentarium, restoration of the partially dentate jaw with tooth-implant-supported fixed prosthesis remains one of the most controversial issues. Some studies found this treatment option an effective and functional solution [Fugazzotto et al. 1999; Oelgiesser et al. 2004] and documented fully successful rehabilitation with no evidence of tooth intrusion and with stable bone levels at both teeth and implants [Palmer et al. 2005; Akca et al. 2006]. Others reported that this therapeutic modality is associated with significant complications [Brägger et al. 2001; Chee & Mordohai 2010]. Most of these potential problems are related to differences in biomechanics between implants and natural teeth [Ochiai et al. 2003; Lin et al. 2005, 2006]. An osseointegrated implant is "rigidly" ankylosed to bone and can move only 10μm in the apical direction, whereas teeth with healthy periodontal ligaments can move in the range of 25–100μm [Sekine et al. 1986; Nyman & Lang 1994]. This foundational dissimilarity in mobility of teeth compared with that of osseointegrated implants may lead to adverse reactions affecting the supporting tissues with resultant mechanical damage of teeth and/or implants, implant components and/or superstructures [Gross & Lauffer 1997; Lauffer & Gross 1998; Nae et al. 2001; Stein 2002]. One recent systematic review addressed the survival and complication rates of fixed partial dentures (FPDs) supported by tooth-implant combination and concluded that survival rates of both implants and reconstructions in combined tooth-implant-supported FPDs were lower than those reported for solely implant-supported FPDs [Lang et al. 2004]. Still there are other [Olsson et al. 2002] who adhere to the view that there is no