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Focusing on Dental Implants

Implant Surfaces: An Update

Many novel dental implant surfaces have been rapidly developed and introduced clinically. Wennerberg from Malmö University and Albrektsson from Gothenburg University, Sweden, undertook a study to identify essential surface parameters; consider the potential advantages of nanoroughness, hydrophilicity and biochemistry; and offer an overview of surface characteristics of the 4 most popular oral implant systems. They then aimed to propose a hypothetical common mechanism explaining the potent bone responses to novel implant surfaces from a variety of commercial companies.

Most commonly sold implant surfaces

1 TiUnite (Nobel Biocare; anodized surface)

2 SLActive (Straumann; acid-etched and grit-blasted, hydrophilic)

3 Osseotite (Biomet 3i; turned collar and acid-etched anchorage portion)

4 TiOblast (AstraTech; blasted with small, micron-sized titanium dioxide particles)

All the novel implant surfaces from various suppliers displayed differences in microroughness, physicochemical properties and nanoroughness from their respective predecessors, which suggested a possible common mechanism for the stronger bone response.

Conclusion

The implant surface's microroughness is vital to bone response, but it is not the sole responsible element. Physiochemical effects and hydrophilic characteristics may also explain strong bone responses. TiUnite, SLActive, Nanotite (Biomet 3i; with 20-nm hydroxyapatite compounds attached to its surface), and the Osseospeed (AstraTech; treated with fluoride ions) all contain nanofeatures on their surfaces, but it is not clear which surface, if any, has the ideal nanoroughness. The authors suggested that the strong bone response to various implant surfaces is an altered nanoroughness pattern, in addition to the other factors enumerated.

Wennerberg A, Albrektsson T. On implant surfaces: a review of current knowledge and opinions. Int J Oral Maxillofac Implants *2009; 24:63-74.*

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Association of Third Molars and Periodontal Pathology in Adolescents and Young Adults

Approximately 50 years ago, researchers suggested an association between the presence of third molars and periodontal pathology affecting adjacent molars. However, because third-molar data are often not collected from patients in clinical or population studies, limited data were available.

The visible presence of third molars in adolescents and young adults has shown significant association with periodontal inflammatory disease of non-third–molars. Blakey et al from the University of North Carolina assessed this association in patients 14–45 years of age who had 4 asymptomatic third molars.

Participants were recruited and voluntarily enrolled in a longitudinal cohort study at the University of North Carolina and the University of Kentucky over a 4-year period. Clinical examinations and panoramic radiographs verified 4 third molars with contiguous second molars.

The patients were classified on the basis of whether at least 1 third molar was visible or all third molars were not visible. The periodontal status of the patients was determined by full-mouth periodontal probing depth data, using 6 sites per tooth. Periodontal inflammatory disease was defined as pocket depth of ≥4 mm in ≥1 tooth other than a third molar.

The study revealed that participants in the visible third-molar group were significantly more prone to have at least 1 pocket depth of ≥4 mm on non-third–molars than were those in the not-visible group. However, in both groups, first and second molars were more likely to be affected than nonmolars: 59% vs 17% in the visible group, and 35% vs 7% in the not-visible group (Table 1). The severity of periodontal disease in the adolescent and young adult patients was low.

Conclusion

The combination of third molars erupting only partially at a later age subsequent to the cessation of jaw growth and the anatomic position of the third molars in the jaws facilitates the accumulation of biofilm. These bacteria are difficult to eliminate with mechanical debridement alone and act as a possible reservoir for microorganisms affecting more anterior regions of the mouth. Thus, the visible existence of asymptomatic third molars may represent a risk marker for periodontal inflammatory disease on non-third–molar teeth.

Blakey GH, Gelesko S, Marciani RD, et al. Third molars and periodontal pathology in American adolescents and young adults: a prevalence study. J Oral Maxillofac Surg *2010;68:325-329.*

Table 1. Percentage of patients with at least 1 third-molar visible (*n* = 342) and those with non-third–molars visible (*n* = 69) by region of mouth

Patients	All PDs <4 mm No. (%)	≥1 PD ≥4 mm No. (%)	First/second molar PD ≥4 mm No. (%)	Nonmolar PD ≥4 mm* No. (%)
≥1 third-molar visible	139 (41)	203 (59)	203 (59)	57 (17)
Non-third–molar visible	45 (65)	24 (35)	24 (35)	5 (7)

Note: Differences between groups are significant for all non-third–molar teeth (p = .0002), *first/second molars* (p = .0002) *and nonmolars* (p = .046).
**Patients also had at least 1 PD of ≥4 mm in first/second molars. PD, probing depth; No., represents number of patients.*

Comparative Evaluation of Anesthetic Efficacy For Irreversible Pulpitis

A common clinical problem dentists encounter is the failure of conventional inferior alveolar nerve block (IANB) to produce satisfactory anesthetic efficacy in the management of painful endodontic emergencies when treating teeth with inflamed pulps. Various hypotheses have been offered to explain the failure of local anesthetic.

- Anatomic variations, such as cross-innervation and accessory innervations with lingual nerve, buccal nerve, mylohyoid nerve or cervical plexus
- Decreased local pH
- Tachyphylaxis of anesthetic solutions
- Activation of nociceptors

The Gow-Gates technique utilizes a single intraoral injection and puncture point to distribute sensory anesthesia to the entire mandibular trigeminal division. This injection requires deposition of anesthetic

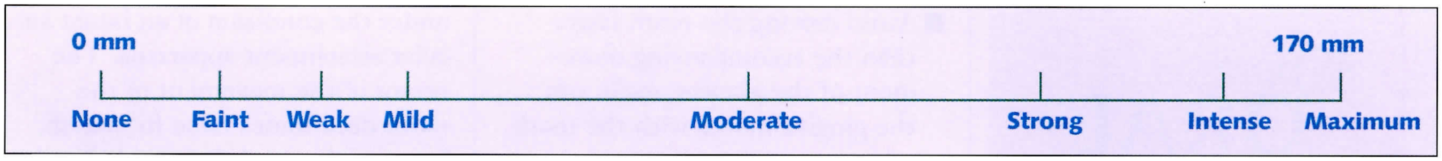

Figure 1. Heft-Parker visual analog scale used for self-assessment of pain.

solution at the lateral side of the mandibular condyle just below the insertion of the lateral pterygoid muscle, thereby bathing the undivided mandibular nerve as it exits through the foramen ovale. Akinosi developed a closed-mouth IANB for patients with diminished mouth opening as is sometimes evident with endodontic emergencies. The technique involves insertion of the needle slightly medial to the mandibular ramus, at the level of the marginal gingivae of the maxillary molars in a closed-mouth position.

Aggarwal et al from Safdarjung Hospital, India, compared 3 alternative techniques that provide anesthesia to mandibular molars with conventional IANB. In a prospective, randomized, double-blinded trial, the authors studied 97 adult volunteers who were actively experiencing mandibular tooth pain. The inclusion criteria for the study also included prolonged response to cold testing with an ice stick and an electric pulp tester. Patients were divided into 4 groups:

- 25 patients received Gow-Gates mandibular conduction block anesthesia
- 24 patients received "high" Vazirani-Akinosi IANB
- 26 patients received buccal-plus-lingual infiltrations with 4% articaine and 1:100,000 epinephrine
- 22 patients, serving as the control group, received conventional IANB anesthesia

Fifteen minutes was allowed for the anesthetic to take effect before the endodontic access preparation was made. A Heft-Parker visual analog scale was used to measure pain during the procedure (Figure 1). The millimeter marks were removed from the scale, which was divided into 4 categories: "no pain" corresponded to 0 mm; "faint, weak or mild pain" corresponded to 1–54 mm; "moderate pain" corresponded to 55–114 mm; and "strong, intense and maximum possible pain" corresponded to >114 mm.

The results of this study revealed a success rate of 52% for the Gow-Gates technique, which was significantly higher than the 36% success rate for the control IANB. Vazirani-Akinosi and buccal-and-lingual infiltrations yielded 41% and 27% success rates, respectively, without any significant differences from the success rate of the control IANB.

Conclusion

The authors concluded that, compared with conventional IANB, Gow-Gates mandibular conduction anesthesia may improve the success rates for anesthesia in patients who have irreversible pulpitis.

Aggarwal V, Singla M, Kabi D. Comparative evaluation of anesthetic efficacy of Gow-Gates mandibular conduction anesthesia, Vazirani-Akinosi technique, buccal-plus-lingual infiltrations, and conventional inferior alveolar nerve anesthesia in patients with irreversible pulpitis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod *2010;109:303-308.*

Tooth Extrusion To Enhance Soft-tissue Implant Esthetics

To maximize the esthetic appearance of implant-supported crowns, the facial gingival margin and the interdental papilla must be in a favorable position. Brindis and Block from Louisiana State University reviewed data on orthodontic extrusion (forced eruption) found in referenced journals. They then made recommendations for the use of this technique according to the evidence.

Previous studies have shown that subsequent to placement of the final crown on an anterior maxillary implant, the facial gingival margin can recede apically 0.5–1.4 mm during the first 3–6 months following surgery. Therefore, the clinician must be cognizant of the fact that if the pretreatment position of the gingival margin is ideal or if it is apical to the ideal planned location, the probable gingival recession will likely result in an asymmetric, nonesthetic outcome.

Orthodontic extrusion can move the surrounding soft tissues in the direction of the incisal edge as the tooth is moved coronally. This alters and enhances the gingival morphology and its relationship to the implant crown.

Animal and clinical research has suggested that orthodontic extrusion causes a temporary stretching of supracrestal and principal fibers, which results in bone formation at the apex and within the alveolar crest. The mucogingival junction maintains a stable position, while the band of keratinized gingiva increases in thickness; when the mucogingival junction maintains its original position, the gingival margin moves with the eruption pattern and creates new keratinized gingiva. The vector of tooth extrusion determines bone formation or bone loss on the facial aspect of the tooth.

For example, if the tooth is orthodontically tipped buccally, applying pressure on the labial bone causes

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bone resorption to occur. With excessive bone resorption, the epithelial attachment moves less than does the tooth, resulting in the apical migration of the attachment along the root surface. However, if tooth extrusion is parallel to the labial bone, there is crestal apposition of new bone up to 2–3 mm.

In the clinical situation, when an implant is planned contiguous to a tooth with crestal bone apical to the tooth's cementoenamel junction, forced eruption of the tooth can be essential for a full papilla to be maintained between the tooth and implant. The bone must be relocated to 5 mm from the planned interdental contact point.

The insertion of a dental implant subsequent to tooth extrusion can diminish gingival margin recession and decrease the time from tooth extraction to restoration. Prior to extraction of a tooth in the esthetic zone, the facial gingival margin should be at least 2 mm coronal to its planned final position after the crown is placed. Overcorrection should be considered when using orthodontic extrusion. A slow rate of tooth extrusion (1 mm/month) has been recommended. But rates as rapid as 1 mm/week can be accomplished without obvious clinical damage to the periodontal ligament space. Generally, an orthodontic extrusion period of 3–6 weeks may be sufficient.

The rate of extrusion should follow the following general principles:

- Avoid moving the tooth faster than the accompanying movement of the gingiva; make sure the gingiva moves with the tooth.
- Avoid moving the tooth rapidly, which will result in excessive tooth instability.
- Move the tooth while maintaining healthy gingiva.
- Move the tooth without excessive discomfort to the patient.
- Move the tooth with constant observation of the incisal edge, which will require modifications to avoid traumatic occlusion as the tooth erupts.
- Move the tooth at a rate that does not move the adjacent teeth used as anchorage.

Once active tooth movement is complete, 6–12 weeks is necessary for tooth stabilization and bone consolidation. Generally, 12 weeks is allowed prior to tooth removal and implant placement.

Contraindications for tooth extrusion

A tooth should not be moved if the following conditions exist:

- the presence of chronic, uncontrollable inflammatory lesions
- an inability to control inflammation and acute infection in the region that would adversely affect healing and response to treatment
- an absence of attachment apparatus, because forced eruption only relocates the existing attachment and does not create a new attachment
- the presence of complete bony ankylosis of the tooth to be extruded so as to avoid intrusion or undesirable movement of the anchoring teeth

Conclusion

Orthodontic tooth extrusion can effectively mobilize the soft tissues under the condition of an intact sulcular attachment apparatus. The vector of the movement of the tooth determines bone formation, because the tooth is extruded and the rate of tooth extrusion is affected by the bone–tooth attachment. Thus, orthodontic tooth extrusion can successfully move the facial gingival margin to permit an esthetic restoration of an implant positioned in the extruded tooth location.

Orthodontic extrusion is a predictable and useful method to move the facial gingival margin to a position that can result in an esthetic implant restoration.

Brindis MA, Block MS. Orthodontic tooth extrusion to enhance soft tissue implant esthetics. J Oral Maxillofac Surg *2009;67(suppl 3): 49-59.*

In the next issue:

- Comparison of success of implants vs endodontically treated teeth
- Evaluation of functional dynamics during osseointegration and regeneration associated with oral implants
- Management protocol for anaphylaxis
- Anatomic structure of the inferior alveolar neurovascular bundle in the third molar region

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