An in vitro study investigated the effects of 3 marginal designs for complete crown preparations on retention and seating of artificial crowns. Three designs were evaluated: chamfer (A), shoulder (B) and beveled shoulder (C). See Marginal Design and Seating Force for Complete Metal Crowns, inside.

UNCERTAINTIES IN PROSTHODONTICS

There are always uncertainties associated with prosthodontic treatment procedures. What is the expected prognosis of implant-supported prosthodontics in patients who have a history of bruxism? Does the selection of the method of retention affect the success rate of implant-supported overdentures? Will the marginal geometry of a tooth preparation and cementation force influence the seating and retention of an artificial crown? Are interchangeable articulators really interchangeable? This issue of Prosthodontics Newsletter reviews reports of recent studies that were designed to answer these questions.
Overdenture Retentive Mechanisms and Health Of Peri-implant Tissues

When 2 implants are used to retain an overdenture, retention can be obtained by using individual stud attachments, a resilient bar or a rigid bar. Most commonly, resilient methods of retention are advocated, and 2 studs or a straight round bar satisfy these recommendations (Figure 1).

A longitudinal study of 90 patients with implant-retained mandibular overdentures was conducted by Oetterli et al from the University of Berne, Switzerland. Straight round-bar retainers were used for 27 dentures, and 7 dentures were equipped with 2 freestanding stud attachments. Bent round bars with limited resiliency were used for 32 dentures. The remaining 24 dentures incorporated rigid retention—12 using straight U-shaped bars and 12 using U-shaped bars with distal extensions.

The mean service time for the overdentures was 4.6 years with a range of 1–7 years; the duration of the study was 5 years. The authors recorded the plaque index, bleeding index and clinical attachment loss for each of the implants.

For comparison, the amount of mandibular atrophy was assessed by cephalometric radiography. Also, for each patient the difference between a line connecting the 2 implants (IA) and the mandibular transverse horizontal axis (THA) was observed, and an angle of divergence (β angle) was calculated (Figure 2). Finally, the length of the edentulous ridges bilaterally (tissue-supporting area) was measured and compared with the implant-supporting area for each denture.

At the conclusion of the study, an increase in the mean plaque index was recorded. There was a mean attachment loss about the implants of 0.25 mm for the entire group of patients. The β angle was ≤5° for >50% of the patients. When the β angle was >5°, there was a slight increase in the mean attachment loss.

Degree of atrophy of the residual alveolar ridges did not influence the peri-implant parameters. Four implants were lost during the study, with a lifetable analysis producing a 95.3% survival rate.

Comment

The amount of clinical attachment loss observed in this study was minimal. When the β angle was ≤5°, the mean loss was 0 mm. For patients with larger β angles, the mean was 0.44 mm—or approximately 0.1 mm per year. These small differences were statistically significant, but the clinical relevance is probably unimportant.

These results suggest that 2 implants supporting a mandibular overdenture are likely to remain clinically healthy for approximately 5 years, regardless of the attachment method of the denture.


Occlusal Wear and Bone Loss About Implants

The cause of bone loss about functioning osseointegrated implants is controversial. Biomechanical overload is thought to influence the rate of bone loss, and it has been assumed that bruxism can be a contributing factor to overload.

Most patients who are bruxists have signs of excessive occlusal wear. A recent study of patients with implant-supported restorations by Engel...
et al from the University of Tübingen, Germany, compared the observed occlusal wear with measured bone loss and Periotest values (mobility measurements).

Of 824 patients treated at the university with implant prosthodontics, 379 were included in the study. Approximately one-third of the patients received removable dentures and two-thirds received fixed prostheses. One implant per patient was selected for radiographic evaluation of bone loss and Periotest recordings. For all patients, data for the implant with the greatest amount of bone loss were used in the study.

One-fourth of the total group of patients had signs suggestive of bruxism, but only one-seventh of the patients with fixed prostheses had wear patterns consistent with bruxism.

Higher bone-loss rates were more frequently associated with implants supporting removable dentures and those with a diameter < 4.5 mm. Observed occlusal wear failed to produce any statistically significant correlation with the rate of bone loss or Periotest values.

Comment
Occlusal wear was most often associated with removable dentures. This observation suggests that the detected occlusal wear may not be the result of bruxism. The acrylic resin artificial teeth used with removable dentures have limited wear resistance. Patients with implant-supported overdentures can generate considerable forces during mastication, far exceeding the forces of occlusion reported for conventional complete denture wearers.

The observed wear found with removable dentures may have been related to the compromised wear resistance of the occlusal material used to fabricate the artificial teeth rather than parafunction. Consequently, this study does not necessarily disprove the assumption that bruxism can be associated with accelerated bone loss, because a cause-and-effect relationship for the occlusal wear patterns was only assumed.

Further studies may help to clarify this issue, and patients with bruxism should be informed that their parafunctional habits might place excessive stresses on osseointegrated implants.


Marginal Design and Seating Force for Complete Metal Crowns

Retention and marginal adaptation of a complete crown are considered important predictors of success and longevity of the restoration. The effects of marginal design and seating force on the retention and marginal closure of a cemented crown have been discussed for decades.

An in vitro study by Piemja from Chulalongkorn University, Thailand, measured final seating and retentive capacities of complete crowns cemented with 2 different cements. Additional variables included seating force and marginal design of the complete crown preparations.

Three finish-line designs were used in the study—classical chamfer, 90° shoulder and 90° shoulder with 45° bevel (see cover illustration). Complete metal crowns were fabricated for the preparation models with each of the 3 finish-line designs. Seating pressures of 25, 100 and 300 N were used for cementation of the crowns (Figure 3).

Marginal discrepancies were related to the seating heights before and after cementation. Retention was measured by tensile testing of cemented crowns with a universal-testing machine.

Higher seating forces improved seating but did not affect retention of the crowns. Better retention was associated with tooth preparations that incorporated the shoulder finish line and the beveled-shoulder finish line. Glass-ionomer cement was more retentive than zinc phosphate cement.

Comment
Previous studies have indicated that retention of a complete crown depends on many factors, and the geometric design of the gingival one-third of the preparation is an important variable. Lower convergence angles are associated with better retention.

The additional reduction of tooth structure at the gingival termination of the crown preparation associated with a 90° shoulder produces a smaller convergence angle of opposing axial walls in this critical area of the tooth preparation. This modification to the preparation may be an important consideration for complete crown preparations.

Figure 3. Seating forces of 25, 100 and 300 N were used for cementation of crowns.
Interchangeability of A Semiadjustable Articulator

Most dentists send casts for prosthetic restorations to a remote dental laboratory for fabrication of prostheses. A number of articulators claim to be “interchangeable,” whereby the dentist can mount casts on a master articulator in the dental office and send only the casts to the laboratory. The technician can then place the casts on a different articulator of the same model in the laboratory without producing a detectable error.

A recent study of an interchangeable articulator, the Hanau Wide-Vue semiadjustable articulator (Teledyne Water Pik), by Chung et al from Northwestern University, Chicago, investigated the degree of error associated with its interchangeability feature. The manufacturer claims that transferring casts between these articulators will produce a mediolateral error that does not exceed 102 μm.

Differences in 3-dimensional spatial relationships of casts were measured for 10 new articulators, 10 articulators that were 18 months old and 10 articulators that had been used for 30 months.

Nine of the 10 new articulators met the manufacturer's criteria of acceptability in the mediolateral direction, but only 4 of the 10 were accurate in 3 dimensions at 166 μm of tolerance. Results also indicated that the 30-month old articulators were not interchangeable with the new articulators and the 18-month old articulators.