Do Root Supported Overdentures Have a Good Prognosis in General Dental Practice?

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ABSTRACT
This paper briefly describes the history of overdentures and the philosophy of their use over the last 150 years. This literature review compares the results of a prospective, longitudinal, cohort study with other published literature. If a patient with a terminal dentition will change behaviors, improve their daily oral hygiene, and follow preventive protocols, then overdenture abutments can be maintained in the mouth for over 20 years. Overdenture abutments have been shown to preserve alveolar bone and stabilize dentures, especially mandibular dentures. They are more cost effective than implants, do not require invasive surgery, and therefore should be considered by general practitioners as a useful therapy, particularly for their older and special needs patients who may be transitioning to complete dentures.

The idea of retaining some teeth/roots and putting a denture (overdenture) over them is not new; it was first described over 150 years ago.1-2 In the 1950s, clinicians noted that when teeth were extracted, the residual alveolar bone resorbed and continued to resorb, which left very little support for complete dentures and made wearing them difficult. Analysis of several longitudinal studies3,4 of edentulous patients wearing complete dentures found that the resorption was progressive, irreversible, and cumulative.4 The rate of resorption was greatest in the first six months after the extraction of the teeth, but the rate varied and was affected by a variety of biological and mechanical factors.4 However, the rate of resorption on the mandible was four times that of the maxilla, as described by Tallgren5 who found that after 25 years of denture wearing, the average bone loss in the mandible was 9 to 10 mm of vertical height compared to 2.5 to 3 mm on the maxilla. More bone loss was found in the anterior part of the jaws, especially in the mandible. Therefore, if teeth or roots could be maintained in the anterior region of the mandible, there would be significant benefit to the patient (Fig. 1).
FIGURES 1A &B: Patient age 72, he has been wearing overdentures for over 15 years.

FIGURE 1A.

FIGURE 1B.

In 1958, Miller reintroduced the idea of maintaining tooth roots in the mouth and placing a denture over them. Morrow et al7 in 1969 published a notable paper which described the benefits of keeping roots as overdenture abutments and described the concept as "preventive prosthodontics." This idea has been supported by two longitudinal studies: For five years, Crum and Rooney8 followed eight subjects with two canines and immediate overdenture abutments and compared them to eight subjects with immediate complete dentures. They found bone reduction of 0.6 mm in the anterior mandible in the immediate-overdenture group and 5.2 mm in the immediate-complete denture group. Van Waas et al9 followed two similar groups of patients for two years, of which 26 had overdentures and 23 had complete dentures. There was significantly less bone loss in the overdenture group compared with the complete denture group. The authors9 stated that "the difference in bone reduction were present not only in the frontal region — near the remaining canines — but also in other regions."

Other advantages of overdentures have been cited in the literature, which includes better stability and retention of the mandibular overdenture.10 There have also been reports of psychological benefits to the patient because they do not feel they are edentulous,11 and there is evidence they maintain sensory perception.12
The prognosis of root-supported overdenture treatment depends on keeping the abutment caries free and periodontally healthy. Therefore, the following assessments need to be made prior to treatments as part of the decision.

- Are the teeth caries free and is the patient following preventive protocol?
- What is the osseous support for the roots and has it changed? • What is the tooth mobility and has it changed?
- What are the probing depths and has there been any attachment loss?
- What is the condition of the gingiva and is there any inflammation?

This literature review will compare the published literature to a longitudinal prospective cohort study of patients who received overdenture therapy at the Department of Prosthodontics, The University of Iowa, from 1974 to 1994. There were 272 persons with 662 abutments who fulfilled the inclusion criteria for analysis. Their mean age was 58.6 years and 62.3 percent were men at the time of delivery of the overdentures.
TOOTH LOSS
The causes of overdenture abutment loss in our study are listed in Table 1. There were 28 abutment failures in 16 subjects for a failure rate of 4.2 percent. Periodontal disease was responsible for 50 percent of the teeth lost and caries was a significant factor in 50 percent of the patients (Fig. 2). Brewer and Morrow, commenting on their study population, stated that "most cases are associated with poor oral hygiene and inadequate follow-up which leads to caries and periodontal disease." They also stated that "almost all abutment failures occur as a result of periodontal disease. Fewer are lost as a result of caries." Our findings are not in agreement with those observations but are similar to the five-year findings of Toolson and Smith. All but four teeth in that study were lost as a result of caries or periodontal disease, which is associated with plaque accumulation due to inadequate daily oral hygiene. In general, poor oral hygiene in this group of patients may reflect the older age of patients with overdentures and an associated inability to clean teeth adequately because the patients have lost fine motor coordination or because of failing eyesight, especially due to cataracts. It could also be due to failure to act on the preventive program outlined by the dentist because of poor self image and/or other emotional problems such as depression or alcohol abuse.

FIGURE 2. Patient aged 55 with rampant caries. She has been wearing overdentures for 5 months and has not brushed the teeth regularly or used a high concentration fluoride.

CARIES
Caries has been identified as a continuing problem for patients wearing overdentures. One reason may be that plaque accumulation under the overdenture results in bacterial colonization and requires significant effort by the overdenture wearer to prevent it. The protocol for subjects who wear overdentures is to remove the denture when sleeping, rinse the mouth, and clean the dentures after every meal. Also, the patient should brush their teeth with a fluoride toothpaste at least twice a day. The added usual clinical regimen for persons wearing overdentures is to have them put one drop of high concentration neutral fluoride gel (5,000 ppm) in the depression of the denture corresponding to the abutment after brushing in the morning, and then seat the denture in the mouth. We have shown that to get the maximum benefit of the fluoride treatment, the patient should not eat or drink anything for at least one half hour (Fig. 3).
FIGURE 3. Showing a patient placing one drop of a high concentration (5,000 ppm) fluoride gel in the overdenture depression in the denture. To maximize the benefit, the patient is asked not eat or drink for half an hour and to place the denture in the mouth with the fluoride in it.

The rate of caries under overdentures has been reported in several longitudinal studies11,15,20,21 and the annual rate for new caries varied from 6.5 percent per year to a high of 20 percent. In our study,20 caries predictor variables included frequency of brushing, use of a high concentration home fluoride gel, certain systemic diseases, and drug effects. Keltjens et al22 reported that they were able to completely inhibit caries development under overdentures for 18 months by using a daily application of chlorhexidine fluoride gel.

When an abutment is cut down and the crown is removed, the dentinal tubules are exposed to the oral environment. The dentin closer to the pulp has been reported to be less calcified than dentin near the root surface.23-25 Therefore, when a tooth is decoronated, the deeper, more porous dentin is exposed and is at a high risk for penetration by organisms associated with caries. Morrow et al7 believed that to protect the overdenture abutments from caries, it was necessary to cover them with gold copings or thimbles. In fact, gold copings increase the cost of overdenture therapy and do not protect the teeth from caries unless the patient has good oral hygiene and uses a high concentration of fluoride or chlorhexidine fluoride gel.20 The most cost effective method of sealing the dentinal tubules is to etch the surface of the cut denture, paint the surface with a fourth generation dentin bonding agent, and then seal the surface by light curing it. This surface will wear and therefore it will need to be resurfaced at various intervals. This treatment does help to protect the abutment from caries (Fig. 4).
FIGURE 4. This 65 year old female has been wearing a complete maxillary denture and a removable partial overdenture for 12 years. Teeth # 22 to 26 are vital teeth which have been cut down and sealed with a fourth generation dentin bonding agent and # 27 has been endodontically treated and the root canal sealed with an amalgam restoration.

PERIODONTAL HEALTH

Periodontal disease has also been identified as a potential continuing risk factor for persons wearing overdentures. When assessing a patient for an overdenture, it is important to determine the prognosis for the potential abutment teeth. A periapical radiograph is required to assess the bone support for the tooth. Zamikoff27 has recommended that at least five mm of alveolar bone support should be present radiographically. The amount of reduction of the tooth, usually requiring elective endodontics, should be about one and a half to two mms above the free gingival margin, and it should be dome shaped.7 The effect of overdenture abutment tooth contour in plaque retention and periodontal health was evaluated over a one-year period.28 One mandibular canine was domed; the other was simply cut down to two mm above the free gingival margin. No significant differences between the contoured abutments was observed after one year.28 The reduction of the abutment tooth to one and a half to two mms above the gingival margin changes the crown-root ratio and reduces the mobility of the abutment by about 40 percent.29

Longitudinal studies have reported a variance in the mobility of overdenture abutments over time. Toolson and Smith11 found no significant change in mobility five years post-insertion of the dentures, nor did Toolson and Taylor30 at ten years after delivery of the overdentures. Renner et al31 in their four-year study found that 50 percent of the abutments had decreased in mobility while 50 percent had no changes. In a three-year study, Reitz et al32 found increased mobility in most of the abutment teeth they evaluated.

As part of the protocol in our study,33 the abutment teeth were scaled and cleaned. The teeth were evaluated to make sure that there were no periapical lesions. There were eight patients who had pockets deeper than 3 mm after debridement and these subjects were referred to our periodontics department for more extensive care, which included surgical recontouring. This protocol was similar to that suggested by Toolson et al34 and Basker et al.35 Although some overdenture abutments have been lost due to periodontal disease, most studies 7,11,30,31,33 that have followed subjects wearing overdentures up to 10 years have found less than 2 mm of bone loss over that time period.
ATTACHMENT LOSS
Lord and Teal36 stated that "to maintain periodontal health, the tissues should be free of inflammation, not bleed when probed, have an adequate band of attached gingiva (3 to 4 mm), and have a vestibular depth that is free of undercuts." Lang and Loe32 stated that if there was less than 1 mm of attached gingiva, chronic inflammation would occur. Although some studies34,38 have reported no significant change in the width of attached gingiva for up to five years of wearing overdentures, we found significant changes. Our clinical longitudinal studies39 of attachment loss found that it was site and arch specific. We found that the greatest loss was on the buccal surface of the mandibular canine. (Fig. 5) This attachment loss may be due to movement of the dentures in function and most movement would be in a buccal-lingual direction. Davis et al40 also reported a significant decrease in the width of attached gingiva in mandibular abutments as did Toolson and Taylor.30 It may be possible to reduce this loss by more frequent recalls of the patients, with more in the mouth relines around the abutments, which could reduce movement and give the clinician the opportunity to encourage better home oral hygiene care.

FIGURE 5. Female aged 81 who has been wearing overdentures for 15 years. There has been no increase in pocket depth but there has been loss of attachment especially on the labial surface of these abutments.

SUMMARY
This literature review of our longitudinal studies compared to those in the literature supports the hypothesis that root-supported overdentures are an effective alternative to conventional complete dentures. Since we are dealing with patients who have a terminal dentition, we need to convince them to change their behaviors so they brush the abutments at least twice a day with fluoride toothpaste and use a daily high concentration (5,000 ppm) of neutral fluoride gel on the abutments. It also requires the patients to return for regular recalls, so any caries or periodontal disease can be treated and the dentures can be relined to prevent excessive movement in function. There is clear data to show that overdenture abutments can be sustained in function for 20 or more years. However, even if the abutments are eventually extracted, the patient will gain a significant benefit from having had the extra support and delay the expected alveolar bone resorption, especially in the mandibular arch.
This discussion cannot end without a comment about a comparison of root-supported overdentures and implant-supported overdentures. The two treatments are very similar for the nearly edentulous mouth, especially for the mandible. Implant-supported overdentures may be more predictable but they are significantly more costly and the patient must be able to withstand an invasive aggressive surgical procedure. Maintenance costs are fairly similar.

I believe it is beneficial for the general practitioner to offer root supported overdentures to his/her patient, because it can indefinitely delay total edentulism by maintain alveolar bone. Overdentures also help to reduce the instability of complete dentures, and particularly mandibular dentures. OH

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