The Retread: A Definition and Retrospective Analysis of 205 Implant-Supported Fixed Prostheses

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Purpose: Acrylic resin teeth on fixed implant prostheses are subject to time-dependent wear. The purpose of this retrospective analysis is to evaluate and describe the management of such wear in the context of selected variables—patient gender and age, dental arch location, and opposing dentition. The clinical and dental laboratory process to replace the worn teeth is defined as a retread. ***Materials and Methods:*** A retrospective database review from a single private prosthodontic practice was carried out on all patients who had undergone a retread procedure. The patient pool included 205 arches in 194 patients (70 in men, 135 in women) with a mean age of 57.4 years (range: 19.9 to 80.5 years). The retread procedure is described. ***Results:*** The mean time between final prosthesis delivery and retread was 7.8 years (range: 1.1 to 22.9 years). Statistical analysis was significant according to dental arch and opposing dentition. A statistical difference was also noted in patients undergoing multiple retread procedures, with a reduction in time between the subsequent procedures. ***Conclusion:*** Acrylic resin components of implant-supported hybrid prostheses wear over time and are influenced by a combination of the nature of the opposing dentition and patient habits. The dental laboratory process to retread the implant-supported framework is important for long-term patient care and maintenance of an appropriate vertical dimension of occlusion. *Int J Prosthodont 2016;29:126–131. doi: 10.11607/ijp.4277*

Acrylic resin prosthetic teeth and veneered metal frameworks, also referred to as hybrid prostheses, are a predictable and integral part of implant therapy for either edentulous arch. Moreover, screw-retained designs coupled with specific clinical and laboratory protocols ensure ease of retrieveability, patient comfort, and function. Nonetheless, a variety of complications are encountered, such as debonding of denture teeth, fractures of veneering material, and different degrees of incisal and occlusal wear.[1–6] Change in occlusal integrity may be significant as it may alter the occlusal scheme and guidance in excursive movements, compromise the integrity of the vertical dimension of occlusion (VDO), affect facial esthetics, and even contribute to the development of angular chelitis. Alterations in teeth wear and associated changes in VDO are variable and diverse and are influenced by the wear resistance of the selected materials, the functional and parafunctional forces to which the teeth are subjected, and the nature and condition of the opposing dentition.

Prolonged loss of VDO may contribute to signs and symptoms of a temporomandibular dysfunction, particularly when degenerative joint disease is already present. Consequently, maintenance of a comfortable VDO should be considered an integral part of ongoing prosthodontic care.

The purpose of this retrospective study is to *(1)* use the analysis of data from a single private prosthodontic facility to underscore the likelihood of acrylic resin teeth wear in the context of gender, age, dental arch, and opposing dentition; *(2)* encourage dentists to confidently inform their patients that such wear occurs quite frequently, that it should be monitored, and above all that the associated consequences can be readily rectified; and *(3)* to define and describe the retread protocol.

Materials and Methods

A retread is the removal of worn veneering material on an implant-supported framework followed by replacement with new veneering material at a desired VDO on the same implant-supported framework.

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Fig 1 Frontal view of worn definitive acrylic resin hybrid prosthesis.

Fig 2 An interocclusal registration is taken with the screw-retained all-acrylic resin interim prosthesis, which allows the master cast to be articulated at the original vertical dimension of occlusion.

Traditional Retread Technique

When the denture teeth in a single arch-implant prosthesis demonstrate a loss of 1/3 of the coronal height of the incisors, a retread is recommended. When significant occlusal wear of the rest of the artificial dentition warrants a retread and the patient recognizes and accepts treatment recommendations, the following clinical protocol should be employed.

Assuming only one arch is being retreaded, an alginate impression and subsequent stone cast is made of the opposing arch. The worn definitive prosthesis (Fig 1) is then removed from the patient and disinfected. Any transmucosal abutments present must be evaluated and checked for stability. The process can be done one of two ways, depending on the presence and functionality of the interim prosthesis. If there is an interim prosthesis that had an appropriate original VDO, the original interim prosthesis is installed and the occlusal relation with the opposing arch is verified.

Using a silicone occlusal registration material (Regisil 2X, Dentsply Caulk), the position of the opposing arches is recorded with the patient closed in centric occlusal position (Fig 2).

The interim prosthesis is then removed, disinfected, and installed on the original master cast with the prosthetic retaining screws. The master cast is articulated using the current occlusal registration against the opposing cast. In some cases, a labial and/or lingual silicone putty index (Lab Putty, Coltene/Whaledent) is fabricated to record the spatial position of the teeth and gingival veneer of the interim prosthesis. With the articulation complete, the interim prosthesis is reinstalled in the patient. If the worn definitive prosthesis is installed on the master cast in the articulator, the degree of wear is clearly evident (Fig 3).

A second technique is used when no interim prosthesis with the appropriate VDO is available. In this case, the clinician has two options: *(1)* traditional denture construction methodology, including the use of a stabilized wax rim to reestablish the appropriate VDO, or *(2)* place shims identical to the amount of wear in the worn prosthesis on the incisal edge of the centrals when the patient closes in centric position with a registration material in place. This creates an interocclusal record on the worn definitive prosthesis at the reestablished VDO.

The dental laboratory then proceeds with retreading the definitive prosthesis. The technician removes the worn acrylic resin from the metal framework along with any framework opaquer that may have been used during the original construction. The framework is then cleaned, and if necessary fresh opaque is reapplied. Some frameworks can also be anodized to modify the underlying color. New denture teeth are then set on the metal framework in wax according to the jaw relation record and labial index. The prosthesis is invested and processed using traditional denture processing technology. After polymerization of the acrylic resin base, the prosthesis is removed from the flask, finished, and polished.

An appointment is made for the delivery of the retreaded definitive prosthesis (Fig 4). The interim prosthesis is stored with the master cast for potential ongoing prosthetic maintenance.

Study Sample/Design

The patient database (Dentrix, Henry Schein) from a single private prosthodontic office was searched for all patients who underwent retread treatment. The inclusion criterion was patients who matched the query

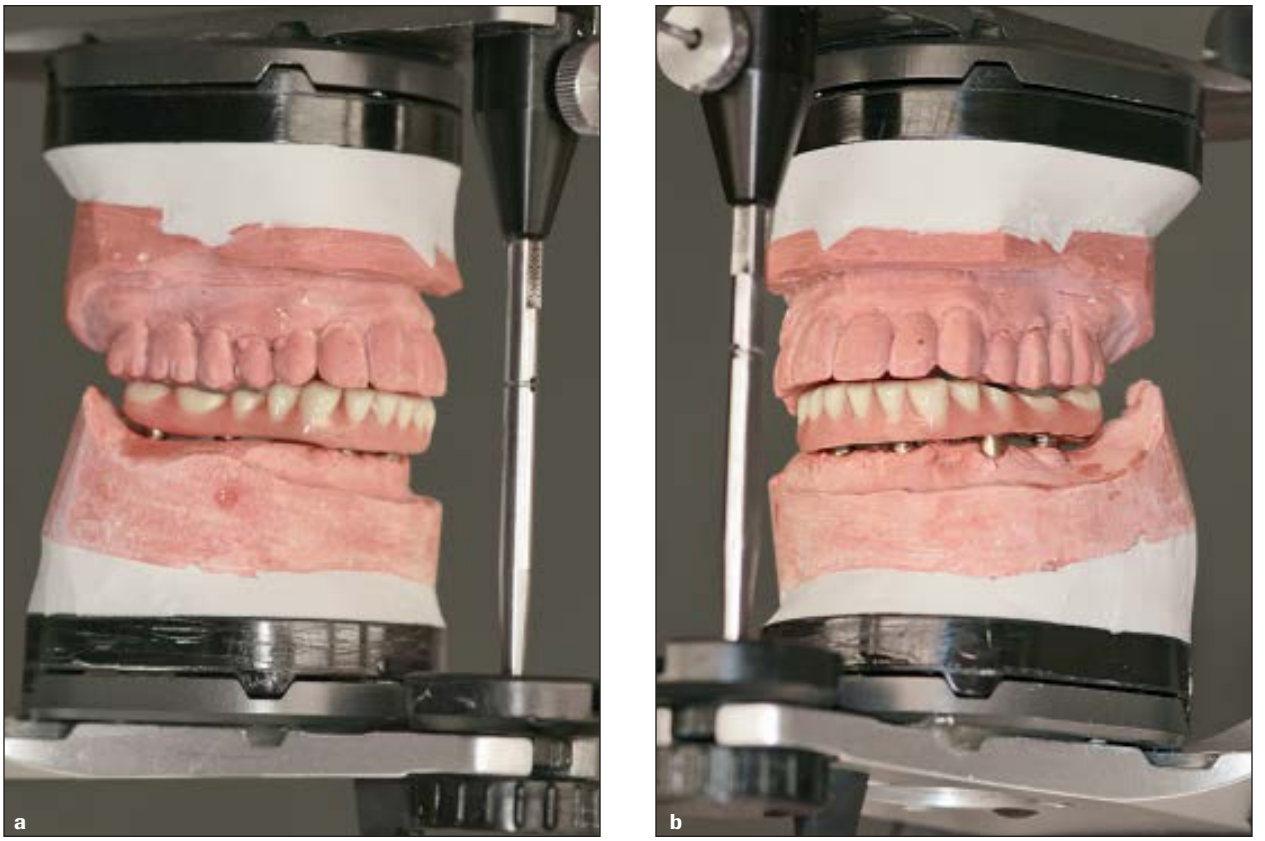

Fig 3 With the worn definitive prosthesis installed on the master cast, the degree of wear from the original vertical dimension of occlsuion is evident in the articulator from the **(a)** right and **(b)** left lateral views.

Fig 4 With the retread procedure complete, the definitive acrylic resin hybrid prosthesis is redelivered to the patient.

entered in the patient database. There were no exclusion criteria. The patient charts were then reviewed to record the data relevant to this study. From February 1986 to August 2010, 205 arches were retreaded in 194 patients (70 in men; 135 in women) with a mean age of 57.4 years (range: 19.9 to 80.5 years). The majority of the retreaded prostheses (184 of 205; 89.8%) were in mandibular arches; the remaining 21 retreaded prostheses were in maxillary arches.

Study Variables

The authors hypothesized that the wear rate and subsequent need for retread may differ depending on patient gender, patient age, dental arch, and status of opposing dentition at the time of definitive prosthesis placement. Opposing dentitions were classified as follows: *(1)* implant-supported ceramometal fixed prosthesis, *(2)* natural tooth-supported ceramometal fixed partial dentures, *(3)* mixed dentition, *(4)* implant-supported fixed hybrid prosthesis, *(5)* removable complete denture, *(6)* natural dentition (which includes removable partial dentures), and *(7)* transitioning dentition. A mixed dentition includes any opposing arch that contains more than two of the listed categories. Transitioning dentition refers to a change from one category to another. Conventional removable partial dentures were incorporated into the natural dentition category since the major cause of wear to the implant-supported fixed hybrid prosthesis was the contact with the natural dentition.

The authors also acknowledge that the type of acrylic resin denture tooth used in the implant-supported fixed hybrid prosthesis may play a role in the wear rate,[7] but this was not included as a study variable since the type of denture tooth used was not recorded or available in the database. In this study, all lab procedures were accomplished in the laboratory in the authors' center, eliminating the laboratory as a study variable.

Outcome Variable

The length of time between definitive prosthesis delivery and the retread procedure was evaluated for all patients and analyzed according to the aforementioned study variables. The patient's decision to do the retread procedure is based on many factors controlled by the patient.

Statistical Analysis

Statistical analyses were performed using analysis of variance (ANOVA) with a 95% confidence level ($P < .05$). The database was maintained in Microsoft Excel and ANOVA was performed on the study variables using the add-on statistical package.

Results

The mean time between final prosthesis delivery and the retread was 7.8 years (range: 1.1 to 22.9 years). The sample was divided into four different age groups as shown in Table 1, with the majority of the patients between the ages of 50 and 70 years. The distribution of opposing dentition is illustrated in Table 2. The majority (103 of 205, 50.2%) of the opposing arches were implant-supported ceramometal fixed prostheses.

Regarding patient sex, the average time for a retread for men and women was 7.23 and 8.12 years, respectively. There was no statistically significant difference between sexes. Regarding patient age, the shortest time (6.44 years) to retread was exhibited in patients aged 70 to 81 years, yet there were no statistically significant trends in the age groups shown in Table 1. Regarding dental arch, the retread times for the mandibular and maxillary arches were 7.59 and 9.86 years, respectively. This 2.27-year difference was statistically significant. Regarding opposing dentition, retreads were performed soonest when the opposing arch was an implant-supported ceramometal fixed prosthesis (6.06 years). That time was statistically significant with all other opposing dentition groups except tooth-supported ceramometal fixed partial dentures. The longest time to retread (11.94 years) was seen when the opposing dentition was transitioned dentition. The majority (52.6%) of these 19 arches were patients who had removable complete dentures and then transitioned to implant-supported fixed prostheses. The various statistically significant differences between the opposing dentition groups are shown in Table 2.

Of the 205 arches, 59 were retreaded a second time with a mean period of 5.28 years following the first retread. Of these 59, 15 had a third retread with a mean period of 3.81 years from the second retread. Of these 15, 4 had a fourth retread with a mean period of 3.04 years following the third retread. Overall time between delivery and first retread was significantly different when compared with the second and third retreads ($P < .05$). However, there was no statistically significant difference between the first retread and the fourth retread. This can be attributed to the limited sample size of arches that had four retreads (Table 3).

Table 1 Distribution of Age and Mean Retread Time

Age (y)	n	Mean retread time (y)
70–81	24	6.44
< 50	46	7.62
60–69	67	8.09
50–59	68	8.12

Table 2 Distribution of Opposing Dentition and Mean Retread Time

Opposing dentition	n	Mean retread time (y)	Statistically significant ($P < .05$)
1) Implant-supported ceramometal fixed prosthesis	103	6.06	3, 4, 5, 6, 7
2) Natural tooth-supported ceramometal fixed partial dentures	6	6.81	5
3) Mixed dentition	15	7.68	1, 5, 6, 7
4) Implant-supported fixed hybrid prosthesis	19	9.22	1
5) Removable complete denture	35	10.26	1, 2, 3
6) Natural dentition	8	10.3	1, 3
7) Transitioned dentition	19	11.94	1, 3

Table 3 Overall Mean Retread Time Frames

No. of retread procedures	n	Mean retread time (y)
1*	205	7.80
2*	59	5.28
3*	15	3.81
4	4	3.04

*$P < .05$.

Fig 5 An implant-supported gold framework retreaded with fully milled acrylic resin (no individual resin denture teeth).

The longest time until a retread was performed was 22.89 years in a 61-year-old woman who had a maxillary implant-supported hybrid fixed prosthesis opposing transitioned dentition. The shortest time until a retread was performed was 1.08 years in a 65-year-old woman who had a mandibular implant-supported hybrid fixed prosthesis opposing an implant-supported ceramometal fixed prosthesis.

Discussion

The presented data is reflective of only those patients who underwent continued maintenance for recognized wear and who both required and agreed to the recommendation of a retread procedure. The time of the retread procedure was noted, although the procedure may have been recommended sooner than it was performed. Other patients not included in this analysis may require retreads but have been lost to follow-up. Consequently, the patient sample for this retrospective study is a biased one, and the report should provide useful and general information on the expected time at which a patient may require a retread procedure.

All patients in the authors' prosthodontic practice are provided with a vacuum-formed occlusal guard at the time of definitive prosthesis delivery to protect against prosthetic complications and wear. However, it is not possible to know how compliant the patients are in wearing the guards. The interim prosthesis guard is also intended to maintain the incisal position and overall VDO.

With the worn definitive prosthesis installed on the master cast in the articulator, the degree of wear is evident. From a patient management perspective, it is beneficial to show the patient the worn definitive prosthesis in the articulator. The space between the prosthesis and the opposing stone cast clearly illustrates the degree of wear that has occurred. It is also an ideal time to reemphasize the necessity of wearing the occlusal guard.

When acrylic hybrid prostheses are employed in both the maxilla and mandible, wear occurs in both arches and the dentist needs to determine the position of the teeth so that the final occlusal scheme and esthetics can be optimally reestablished. The present authors prefer limiting the wear factor to one arch; under ideal circumstances, the maxillary arch is restored with porcelain and the mandibular arch with acrylic resin, thereby directing all wear risk to the less wear-resistant acrylic resin teeth.

Patients in the recorded data who have been compliant with follow-up care and have experienced multiple retread procedures had a mean decrease in time between subsequent retreads and the initial retread (Table 3). The decrease in time is statistically significant. While this may indicate a more rapid degree of tooth wear over time, it may simply be related to the ease and perceived value of the process causing the patient to agree to the process sooner.

Dentists would be wise to discuss wear factors and retread procedures with patients at the initiation of implant prosthodontic treatment. It would be beneficial to include this information in the written informed consent for treatment. Office brochures illustrating long-term maintenance of implant-supported prostheses, including wear and the need for retreads, are a positive adjunct to any prosthodontic practice. Such prior patient education can avoid surprises and confrontations between the patient and the clinician.

The Teeth-in-a-day interim prosthesis[8] is worn by the patient during the laboratory procedures to retread the original metal framework. If the original interim prosthesis is unavailable, the authors strongly recommended fabrication of a new all-acrylic resin prosthesis for patient comfort, function, and esthetics to wear while the dental laboratory completes the retread procedures. The laboratory construction time is usually 1 week, but can be expedited. To verify tooth position, a wax try-in on the original framework is an option, if necessary.

It is also imperative to maintain the original master cast on which the definitive prosthesis was fabricated. If hard and/or soft tissue anatomic changes have occurred since the fabrication of the definitive prosthesis, a new open-tray pick-up impression of either the interim or the worn definitive prosthesis is highly recommended. The resulting new master cast is then articulated at the original VDO against the opposing cast.

With the progression of digital dentistry and digital prosthodontics, a monolithic, polychromatic, robotically milled acrylic resin (AvaDent, Global Dental Science) can be effectively applied to an existing metal framework as an alternative retread technology (Fig 5). Early observations regarding this technology are fewer prosthodontic complications. It is unknown

at this time whether this technology will increase the time before a retread is required, and further studies need to be conducted to analyze the long-term wear of these materials. In one study of wear of AvaDent fully milled teeth simulating 2 years of function (600 k cycles), no significant wear difference was found when compared with Dentsply IPN teeth.[9]

Conclusions

Implant-supported hybrid prostheses wear over time. Patient age and patient gender did not appear to affect the wear rate of the hybrid prosthesis; however, dental arch and the opposing dentition of the prosthesis requiring the retread did affect the wear rate. Individual patient habits such as parafunction and compliance with wearing the nighttime occlusal guard also affected the wear rate. The dental laboratory process to retread the implant-supported framework is important for long-term maintenance of the appropriate VDO. The procedure is easy for the patient when an interim acrylic-resin implant-supported prosthesis is available.

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Literature Abstract

Dental and Microbiological Risk Factors for Hospital-Acquired Pneumonia in Non-Ventilated Older Patients

Hospital-acquired pneumonia (HAP) is the most common hospital-associated infection and is linked with high mortality, hospital costs, functional decline, and increased length of hospital stay. The mouth is known to be the main reservoir of infection, and some studies have suggested that oral hygiene interventions may prevent HAP. Therefore, the aim of this study was to investigate whether HAP was associated with prior oral carriage of respiratory pathogens or prior heavy dental or denture plaque, and also to determine whether HAP was more common in patients whose mouths had acquired or become colonized by organisms detectable within 14 days of hospital admission. Ninety patients with lower limb fractures, aged 65 to 101 years, provided oral swabs 1, 3, 5, 7, and 14 days after admission. All patients (apart from two who were treated without operation) received perioperative antibiotics. Real-time multiplex polymerase chain reaction assay was then used to detect *S aureus*, methicillin-resistant *S aureus* (MSRA), *E coli*, *P aeruginosa*, *S pneumoniae*, *H influenza*, and *Acinetobacter spp*. Additional data on dental/denture plaque (modified Quigley-Hein index) and outcomes of clinician-diagnosed HAP were collected. The incidence of HAP was 10% (n = 90), with mortality of 80% at 90 days postdischarge. HAP was found not to be associated with being dentate, tooth number, or heavy dental/denture plaque, but it was associated with prior oral carriage with *E coli/S aureus/P aeruginosa*, and with increased length of stay. Patients with lower limb fracture who were colonized orally with *E coli/S aureus/MRSA/P aeruginosa* after 5 days in hospital were found to be at a significantly greater risk of HAP. Consideration should be given to the small sample size of the study, the limited time frame of 14 days, and the influence of other risk factors.

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