Mechanical Failure of an Implant-Retained Bar: A Clinical Report

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This clinical report describes the mechanical failure of an implant-retained bar where the bar fractured midway between two implants. The location of the fracture is not typical for implant-retained bars. Possible causes of the fracture are discussed. The prosthodontic treatment provided to manage the mechanical failure and prevent it from recurring is also discussed.

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INDEX WORDS: bruxism, occlusal device, implant-retained bar, overdenture, dental implants

THE USE of implants in the treatment of edentulous patients is well documented in the prosthodontic literature. A common form of treatment is the use of an implant-retained bar to support an overdenture. This form of treatment is associated with a high patient acceptance rate because of increased denture retention and stability, increased biting efficiency, and an improved quality of life;¹⁻³ however, this form of treatment includes disadvantages and complications such as prosthesis fracture, extra bulk caused by the presence of the metal bar, and the need for frequent maintenance.⁴⁻⁶

This clinical report describes the mechanical failure of an implant-retained bar and the prosthetic treatment provided.

Clinical Report

A 56-year-old Caucasian female presented with the following chief complaint: "My denture is becoming loose; it has been a year, and I want the clip changed." Upon examination, the patient presented with a maxillary overdenture supported by a two-implant-retained bar, opposing a mandibular fixed detachable prosthesis. The maxillary overdenture was retained on the bar using a nylon clip (Sterngold, Attleboro, MA). Further examination of the implant-retained bar revealed a midline fracture (Fig 1).

A review of the patient's record showed that the bar was fabricated from Type III Gold (Firmilay, Jelenko, Heraeus Kulzer, Inc., Armonk, NY) and was soldered at the junction of the bar and the abutment away from the fracture line. A wear facet directly related to the area of the fracture was observed. The patient reported removing her maxillary over-denture when she sleeps at night. When the patient was asked to occlude against the bar, the mandibular fixed detachable prosthesis occluded on the bar (Fig 2). The patient revealed a history of parafunctional habits.

Prosthodontic Treatment

The patient was informed of the findings, and the treatment plan was discussed. The goal of treatment was to correct the problem and to avoid future complications. The prosthodontic treatment plan consisted of:

- fabrication of a new implant-retained bar using a metal with higher yield strength;
- 2. reline of the existing maxillary overdenture to fit the newly fabricated bar;
- fabrication of an occlusal device from heatpolymerized acrylic resin;
- 4. patient instructions; and
- 5. recall and maintenance.

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Figure 1. Implant bar fractured midway between the implants (arrow showing the fracture line and wear facets).

Discussion

Framework fracture is one of the mechanical complications associated with implant treatment. In patients where a passive accurate fit of the framework and a carefully equilibrated occlusion is provided, framework fractures usually occur because of inadequate thickness of the metal framework⁷ or poor solder joints.⁸

Type III gold has a high yield strength (40,000 psi). With this patient, one would expect the fracture to occur at the solder joint,⁸ not in the middle of the bar. Further examination of the fracture site using magnification and radiographs showed no presence of voids that could weaken the bar and explain the fracture. The presence of a wear facet on the bar supports the notion that the fracture was caused by an occlusal overload



Figure 2. Articulated casts of the fractured implant bar in occlusion with the opposing mandibular prosthesis (arrow indicating the fracture line).



Figure 3. New implant-retained bar.

of the bar, related to nocturnal parafunctional habits.

To prevent recurrence, a ceramo-metal (Classic 4, Jensen Industries Incorporated, CT) with higher yield strength ($\approx 50,000$ psi) was used to fabricate the new implant-retained bar (Fig 3). This is significantly higher than the yield strength $(\approx 40,000 \text{ psi})$ provided by Type III gold. The occlusal overload caused by nocturnal parafunctional habits can also be minimized with the use of an occlusal device.9 The occlusal device covered the implant-retained bar and extended to fully cover the edentulous maxillary arch. The occlusion was adjusted to provide the patient with simultaneous contact in centric occlusion and protrusive and laterotrusive movements. The patient was instructed to wear the occlusal device over the bar at night after removing her maxillary implantretained overdenture, to prevent occlusal trauma from nocturnal parafunctional habits, and to avoid direct contact between the mandibular-fixed detachable prosthesis and the implant-retained bar.

Conclusion

When using implant-retained overdentures in treating edentulous patients, the clinician must consider the forces created by the opposing dentition on the implant bar, especially at night when the patient removes the overdenture. This report shows that the contact of the bar with the opposing fixed detachable prosthesis resulted in the fracture of the bar. The prosthodontic steps to prevent recurrence of the fracture are described. The use of a metal with higher yield strength, the utilization of an occlusal device, frequent maintenance visits, and the patient's cooperation provided a better prognosis for the prosthesis.

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