CLINICAL REPORT

Rehabilitation of a Spark Erosion Prosthesis: A Clinical Report

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When complex prostheses are fabricated, it is expected that at some point maintenance will be necessary. This clinical report documents a 10-year-old maxillary spark erosion prosthesis that had been repaired many times, was discolored, and exhibited significant signs of wear. The metal superstructure was intact; therefore, only the acrylic resin base and teeth needed to be replaced. To reduce both cost and time without the prosthesis for the patient, the rehabilitation was completed within 24 hours.

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SPARK EROSION is the process by which metal is altered in a form using short-circuit impulses created within a dielectric medium similar to light oil. This allows for precision metal removal using a controlled electrical discharge to erode metal as much as 250,000 times per second without overheating the alloy.[1] The idea for spark erosion came from watching lightening. In the 18th century, Sir Joseph Priestly considered this occurrence and its effect on metal. After World War II, the Russian Lazerenko brothers established their first electronic erosion apparatus. The spark erosion process became more popular in the early 1940s in the tool and die industry.[2]

Since then, the dental profession has adapted its uses for fabricating precision-removable partial dentures, titanium crowns, and implant-retained overdentures. For use with an implant-retained overdenture, a screw-retained framework is milled with 2° tapered walls. A removable superstructure is then fabricated. Both the screw-retained framework and the removable superstructure are spark eroded to create a very passive, intimate fit.[3]

Achieving a passive fit between the implants with the infrastructure and the superstructure is imperative for long-term osseointegration.[4] Mechanical failures from a nonpassive fit may cause mechanical failures of the implants and/or the prosthesis or may adversely affect the surrounding gingiva.[5] Spark erosion offers excellent retention, support, and stability similar to that of a fixed prosthesis. When a fixed prosthesis is not an option, the spark erosion prosthesis offers the patient a precision-fit removable palateless overdenture with outstanding stability and retention.[3]

This clinical report describes a method to improve the esthetics and function of a long-term spark erosion prosthesis without the use of an interim complete overdenture and without the expense of a commercial laboratory. With time and adequate facilities to carry out this process, it offers a fast, acceptable alternative for the patient.

If this option had not been available, an interim complete overdenture would have been fabricated, adding both time and expense to the process. The infrastructure would have been removed from the patient's mouth and replaced with healing abutments. Both the infrastructure and the prosthesis would have been sent to a commercial lab for fabrication. The alternative method described in this clinical report allowed for minimum expense and inconvenience for the patient.

Clinical Report

The patient originally presented to the University of Maryland Dental School in late 1990. All

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Figure 1. 1990 Panorex with implant fixtures placed and restored.

remaining teeth were extracted and replaced with implants of various sizes. Six implants were placed in the maxilla and five in the mandible. The maxilla was restored with a spark-eroded palateless removable prosthesis, and the mandible was restored with a screw-retained ceramometal fixed partial denture (Fig 1). The patient presented to the clinic every 6 months for hygiene recall appointments.

Over a period of 10 years, the removable maxillary prosthesis had been repaired numerous times, showed signs of wear, and had evidence of discoloration (Fig 2). Two rehabilitative options were presented to the patient. One was a 24-hour process to be completed at a laboratory within the university. The other option was to remove the infrastructure, place healing abutments, and use an outside laboratory to rehabilitate the prosthesis. The second option would have taken weeks to complete and would have required that the patient have an interim prosthesis. The patient chose the first option. The 24-hour process offers several benefits to the patient. The cost is less, because no additional prosthesis is necessary, and the laboratory cost is significantly less. Additionally, fewer appointments are needed, and the patient is without the prosthesis for hours rather than days.

Figure 2. Cameo surface of prosthesis before rehabilitation.

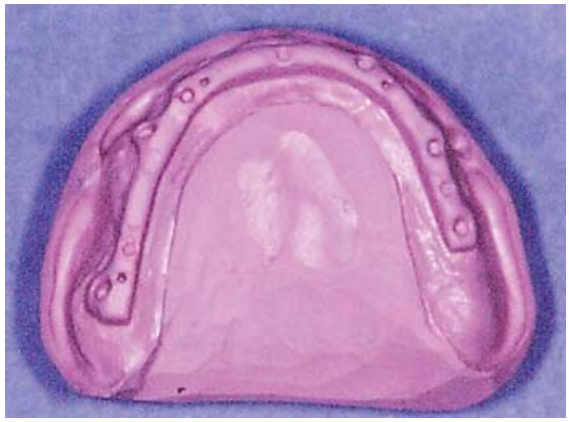

Figure 3. Putty cast of intaglio surface of prosthesis used for rehabilitation process.

Several days before the rehabilitation appointment, a cast of the maxillary substructure was made with lab putty (Coltène Whaledent, Cuyahoga Falls, OH), and a stone base (Whip Mix, Louisville, KY) was added for mounting on an articulator (Fig 3). A face-bow transfer record using the existing prosthesis was obtained. An opposing cast was made and mounted on a Hanau H2X articulator (Waterpik Technologies, Inc., Pittsburgh, PA) (Fig 4) using an interocclusal

Figure 4. Prosthesis mounted against mandibular cast before rehabilitation.

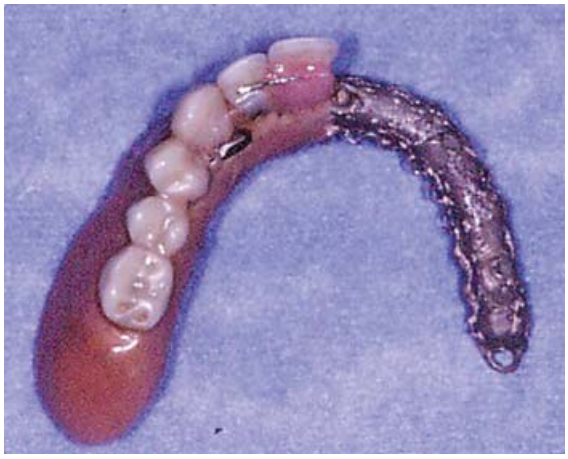

Figure 5. Superstructure with one-half of acrylic and teeth removed.

Figure 6. New cameo surface of prosthesis after rehabilitation.

record. The occlusal vertical dimension (OVD) was assessed using the physiologic rest position, and, although there was a decrease of 4 mm registered, the OVD was not altered because the closest speaking space was 1 mm, and the patient was very comfortable at this OVD.

The patient presented to the Postgraduate Prosthodontic Clinic in the morning; after disinfection, the spark erosion removable prosthesis was taken to the laboratory to remove one-half of the existing acrylic base and teeth exposing the metal superstructure (Fig 5). New teeth were set in Type III extra-hard baseplate wax (Dentsply International, Inc., York, PA) and tried in the patient's mouth to verify both esthetics and phonetics. After verification, the process was repeated on the other half of the metal superstructure. Again, it was tried in the patient's mouth to verify esthetics and phonetics. Once the patient approved of the tooth position, size, shade, and shape, the patient was dismissed and asked to return the next morning.

The prosthesis was disinfected and taken to the laboratory for final processing. The wax up was sealed down to the putty cast with additional wax and then flasked like a conventional complete denture. Once the boil out was completed, the metal superstructure was sealed to the putty cast with cyanoacrylate (Elmer's Products, Inc., Columbus, OH). This was done to prevent acrylic resin from reaching the internal surface of the superstructure where various attachments are located.

Acrylic resin (Lucitone 199, Dentsply International, Inc.) was mixed and packed when it reached a doughy stage. The trial packs were eliminated, and only a final pack at 3000 psi was performed. The flask was placed in a clamp and then into a processing tank at 165°F for 10 hours. The following morning, the prosthesis was deflasked, finished, and polished (Fig 6). The patient returned for insertion at which time home-care instructions were given (Figs 7 and 8).

Discussion

Although this was a labor-intensive process in a short amount of time, it provided several

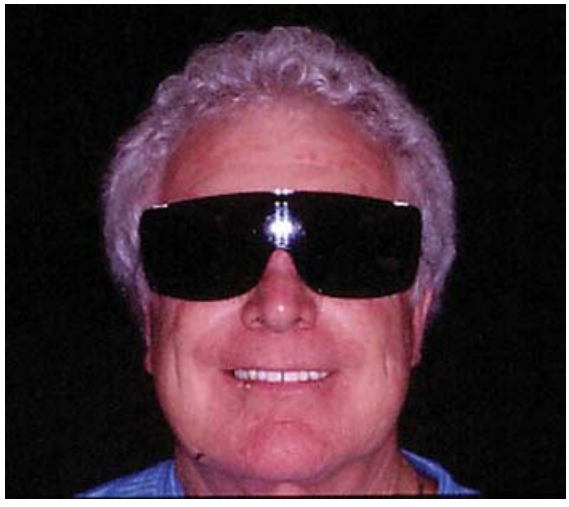

Figure 7. Frontal smile after rehabilitation.

Figure 8. Close up of smile after rehabilitation.

advantages for the patient. It allowed for a wax try-in to verify OVD, esthetics, and phonetics. The laboratory time and fees decreased, resulting in a reduced cost for the patient. The additional cost of new healing abutments was avoided, and lastly, the patient was without the prosthesis for a minimal amount of time. If the facilities and time are available, this method for rehabilitating a maxillary spark erosion prosthesis is an option with multiple advantages.

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