Installing Magnetic Keepers Using LASER Welding

Masatoshi Ishikawa, DDS, PhD,[1] Toshiya Kashiwabara, DDS,[1] Osamu Ishida,[2] and Tetsuo Ichikawa, DDS, PhD[3]

Magnetic overdenture attachments can provide useful denture retention. A technique is proposed that involves installing the magnetic keeper in the overdenture abutment coping using laser welding. Compared with the conventional cast-to technique, the new technique provides a suitable contour to the abutment coping with the magnetic keeper and ensures proper mounting in the abutment coping, installing the magnetic keeper easily and effectively.

J Prosthodont 2002;11:49-52.

INDEX WORDS: denture retention, overdenture abutment coping, magnet, laser welding

A MAGNETIC attachment (Aichi Steel Corp, Aichi, Japan) that helps to retain overdentures is popular in Japanese prosthetic treatment and has been used in over a half million patients with satisfactory results (Fig 1).[1-3] A variety of magnetic attachments are produced to meet different clinical situations. The magnetic attachment assembly consists of 2 parts: a rare earth magnet and a magnetic stainless steel keeper. The magnet is made of an alloy containing Ne-Fe-B and is completely shielded by a stainless steel magnetic alloy (AUM20), the same material used as the keeper. Little magnetic-exposure hazard or corrosion has been found in long-term observations.[1,4]

Conventionally, the magnetic keeper is mounted in the overdenture abutment coping using the cast-to technique (Fig 2). The keeper and the encasing metal of the abutment coping are fixed together by mechanical interlocking and without metal fusion. This technique often requires overcontouring of the abutment coping when the tooth root is narrow, which may cause periodontal problems.

Recently, laser welding has gained wide acceptance as a dental laboratory technique for joining metals.[5,6] Laser welding can be used to fix the magnetic keeper into the abutment coping. In this article, a new technique is described for the installation of magnetic keepers into abutment copings using laser welding.

Technique

1. Overdenture abutments are prepared, and a final impression is made.
2. Overdenture abutment copings are waxed with suitable contours (Fig 3). After casting, the occlusal surfaces of the abutment copings are flattened using abrasive paper (Fig 4).
3. A 1-mm-thick magnetic steel plate of AUM20 (Aichi Steel Corp) is trimmed to form keepers of suitable dimensions for the root caps and magnets (Fig 5). Generally, the magnetic keepers must be larger than the magnets because the keepers should be trimmed to suitable contours after welding. If the reshaped keepers are smaller than the magnets, magnetic retentive forces decrease.[7]
4. The magnetic stainless steel plate keepers are placed on the abutment copings, and the interfaces between the plates and the abutment copings are welded using a laser-welder (Com4 Laser, Dentaurum; J. P. Winkelstoeter KG, Pforzheim, Germany) (Fig 6).
5. After welding, the abutment copings are shaped and polished (Fig 7).

From The University of Tokushima, School of Dentistry, Tokushima, Japan.

[1]Research Associate, Department of Removable Prosthodontics.

[2]Chief Dental Technician, Dental Laboratory, University Dental Hospital.

[3]Professor and Chairman, Department of Removable Prosthodontics.

Accepted September 25, 2001.

This clinical research was supported by the International Research Project of Magnetic Dentistry (Aichi Steel Corp).

Correspondence to: Masatoshi Ishikawa, DDS, PhD, Department of Removable Prosthodontics, The University of Tokushima, School of Dentistry, 3-18-15 Kuramoto, Tokushima 770-8504, Japan. E-mail: masatosi@dent.tokushima-u.ac.jp

1059-941X/02/1101-0010$35.00/0

doi:10.1053/jpro.2002.30029

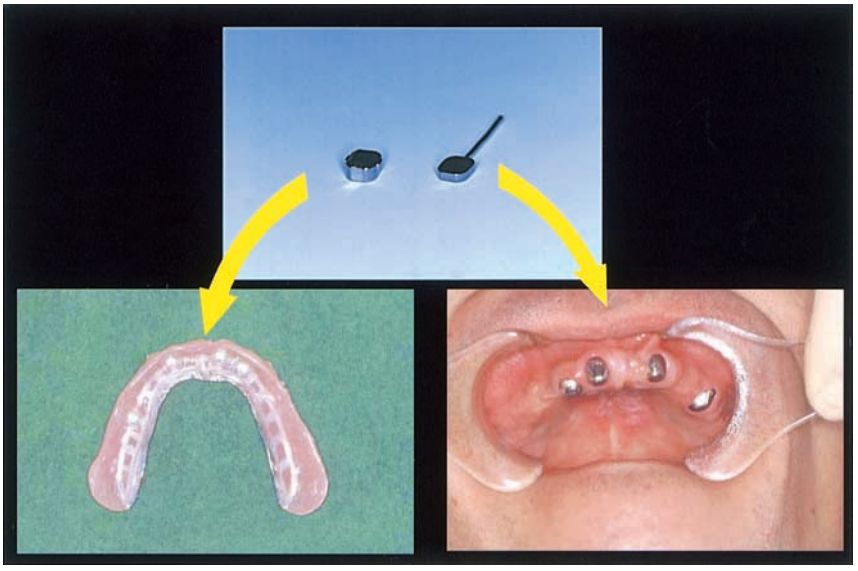

Figure 1. A magnetic attachment assembly is shown (Magfit; Aichi Steel Corp). The magnetic assembly is embedded in the denture, and the keeper is mounted in the overdenture abutment coping.

6. The copings are then luted to the abutment teeth (Fig 8), and an impression for the overdenture is made.

Discussion

Laser welding of keepers to overdenture abutment copings offers a number of advantages when compared with the conventional cast-to technique. Laser welding simplifies fabrication procedures for magnet-retained overdenture attachments. Also, welding the keeper helps to eliminate over-contouring of the abutment coping. This problem, commonly seen on teeth with narrow roots, is reduced because less encasing metal is required with laser welding as compared with the traditional cast-to technique.

Corrosion has been documented as a problem with the use of dental magnetic attachments. However, for the system described, the keeper metal has a sufficient corrosion resistance for use in the oral cavity.[8] With the conventional cast-to technique, corrosion resistance decreases because of heat shock encountered in the lost-wax casting procedure.[9,10] Diminished corrosion resistance in conjunction with the effects of galvanism may promote separation of the keeper from the abutment coping. Mounting the keeper in the root cap using the laser-welding technique avoids extreme temperature increases and, as a result, circumvents corrosion-associated problems.

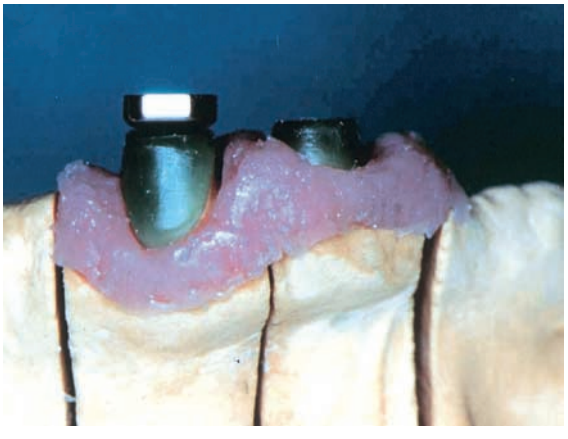

Figure 2. The ready-made keeper is encased when the abutment coping is conventionally waxed. The keeper must be surrounded by dental metal to a thickness of 1 mm. Over-contouring often occurs if the tooth root is narrow.

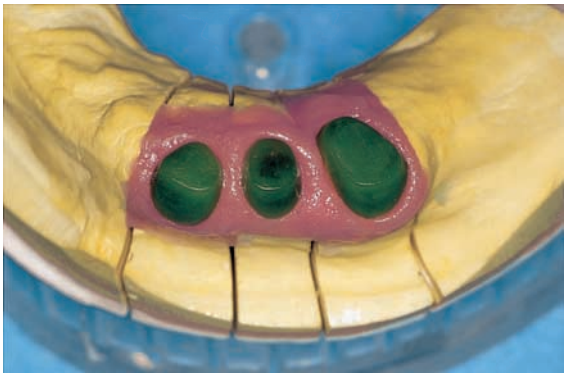

Figure 3. The abutment coping is waxed to a suitable contour.

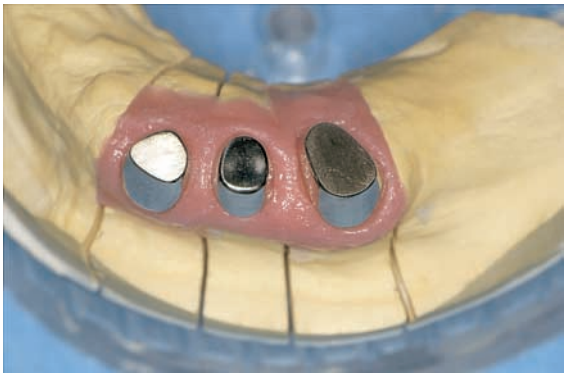

Figure 4. The occlusal surface of the abutment coping is flattened using abrasive paper.

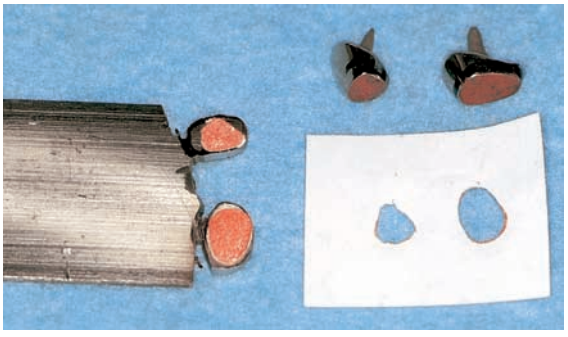

Figure 5. Sizing and trimming of the 1-mm-thick magnetic stainless steel plate is facilitated with the use of paper cutouts.

Figure 6. The abutment coping is shown after laser welding.

This new technique for installing magnetic keepers is technically easy to accomplish and provides significant benefit to the patient. As the popularity and availability of laser welding increases, this technique, with its advantages of more favorable abutment coping contour and diminished keeper corrosion, should become a laboratory standard.

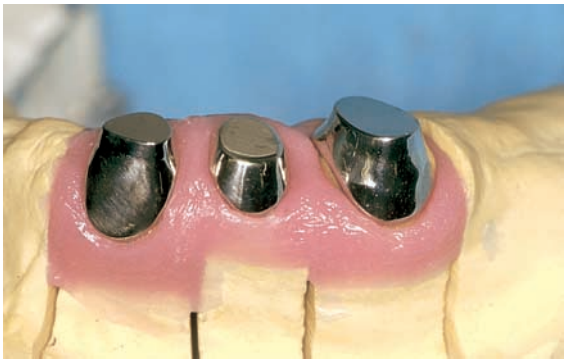

Figure 7. The abutment coping with the magnetic plate is shown after polishing.

Figure 8. The abutment copings are shown at a 3-month recall appointment.

References

1. Tanaka Y, Bando E, Nagamachi N, et al: The application of the sandwich-type dental magnetic attachment, "MAGFIT-600" in various clinical cases. J Jpn Prosthodont Soc 1992; 36:471-480 (in Japanese, Eng. abstr)
2. Tanaka Y, Nakamura Y, Desaki Y, et al: Development of MAGFIT-EX SYSTEM as a second generation of the magnetic attachment. J Jpn Magn Dent 1996;5:24-30 (in Japanese, Eng. abstr)
3. Ishigami T, Tanaka Y: The success of magnoprosthetics in Japan. J Jpn Magn Dent 1998;7:35-40
4. Sato K, Yamaguchi H, Miyamoto H, et al: Growth of human cultured cells exposed to a non-homogenous static magnetic field generated by Sm-Co magnets. Biochim Biophys Acta 1992;1136:231-238

5. Bergendal B, Palmqvist S: Laser-welded titanium frameworks for implant-supported fixed prostheses: A 5-year report. Int J Oral Maxillofac Implants 1999;14:69-71
6. Ishikawa M, Kashiwabara T, Ishida O, et al: Clinical application of LASER welding for prosthetic practice. Quintessence Dent Technol 1999;24:1593-1601 (in Japanese)
7. Mizutani H, Kadoyama N, Ai M, et al: Influences of the dental magnetic keeper area and the setting location on attractive force. J Jpn Magn Dent 1992;1:61-70 (in Japanese, Eng. abstr)
8. Tanaka Y: Dental Magnetic Attachment. Tokyo, Japan, Ishiyaku, 1992, pp 113-116 (in Japanese)
9. Morito M, Hasegawa K, Hirano S, et al: Clinical observation on magnetic keepers. J Jpn Magn Dent 1996;5:45-50 (in Japanese, Eng. abstr)
10. Desaki Y, Kishimoto Y, Tanaka Y, et al: Experiments on corrosion of the magnetic stainless steel used for certain magnetic attachments. J Jpn Magn Dent 1996;5:67-73 (in Japanese, Eng. abstr)