Custom Cast Ball Attachments Used on Outdated Implants to Restore a Maxillary Implant-Supported Overdenture

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The lack of compatible prosthetic components can be a complication during oral rehabilitation using outdated implants. The aim of the present clinical report was to describe an alternative technique for the fabrication of a maxillary implant-supported overdenture in a patient with 20-year-old dental implants using castable spherical patterns and ball attachments. The patient had been wearing a relined bar/clip overdenture in the mandible on 4 external-hexagon dental implants and a relined complete denture in the maxilla on 4 internal-hexagon implants due to abutment screw fracture inside of the implants, losing the attachment system. The remaining maxillary dental implants did not possess attachments compatible with current systems due to configuration changes by the manufacturer in the dental implant's platform and the components over time. Therefore, castable spherical patterns and cast ball attachments were used to fabricate a maxillary implant-supported overdenture. The mandible rehabilitation was performed using 4 osseointegrated dental implants with a fixed implant-supported prosthesis. The use of cast ball attachments on the maxillary dental implants avoided invasive procedures on the remaining implants. Considering the lack of available compatible prosthetic components for the osseointegrated implants, this technique was considered a viable and satisfactory treatment option.

Key Words: Overdentures, dental implants, denture attachment, biomechanics

INTRODUCTION

Osseointegrated dental implants have been used in edentulous patients to increase the retention and stability of complete dentures.[1] The use of a maxillary implant-supported overdenture with an attachment system can improve neuromuscular activity, masticatory performance, proper phonetics, and aesthetics.[1] Furthermore, hygiene maintenance is facilitated in comparison with other dental prostheses.[1,2] However, biological and technical complications can occur in implant therapy,[3] especially in outdated osseointegrated implants by discontinued manufacturer systems. In situations such as dental implant fracture, malposition, irretrievable broken screw, or abutment,[4] and when an attachment system is not compatible with the implant due to changes in the manufacturer or because there is no compatible system, removal of the implant is usually the best option. Methods for removing outdated osseointegrated implants include the use of an implant retrieval kit, thermo explantation (electrosurgery), excision with a thin bur at low speed with irrigation, or with a trephine.[5] However, these are traumatic methods that could compromise the bone around the implant[4] and the level of soft tissue.

Some techniques[6–8] have been used to management a fracture abutment screw of mandibular implant-retained overdentures using special equipment with castable attachments or installing a new attachment after removal of the screw. However, the literature is scant regarding nontraumatic treatments when outdated implants are needed to restore an implant-supported overdenture. In such cases, a castable attachment—used to restore teeth with endodontic treatment during oral rehabilitation—is a nontraumatic and low-cost treatment option that could be used on outdated implants, thereby avoiding traumatic removal methods of the implant and maintaining the bone tissue and patient's health. In addition, this technique is simple and does not require special equipment. However, in cases where the dental implant is osseointegrated and can be maintained, or when the patient does not want to remove it, other treatment options should be considered.

The aim of the present clinical report was to describe an alternative technique for the fabrication of a maxillary implant-supported overdenture in a patient with approximately 20-year-old dental implants using castable spherical patterns and ball attachments.

CASE REPORT

A 70-year-old man visited the Department of Dental Materials and Prosthodontics of the Araraquara Dental School, complain-

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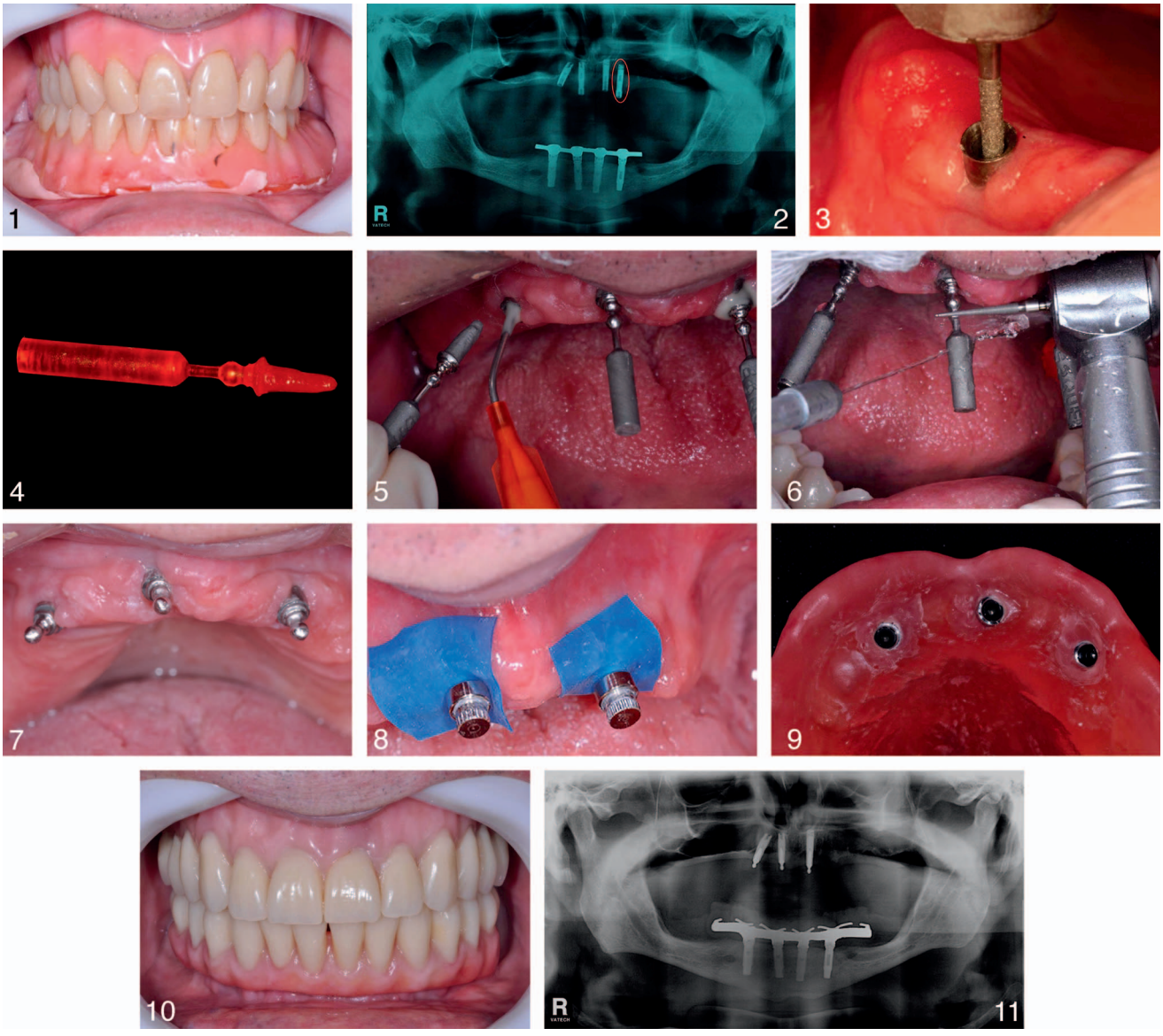
DOI: 10.1563/aaid-joi-D-16-00156



Figures 1–11. Figure 1. Initial appearance of the implant-supported prostheses. **Figure 2.** Pretreatment panoramic radiograph. The implant in the left pre-molar region of the maxilla was loose. **Figure 3.** Removal of internal threads using a diamond bur before molding the inner surface of the implants with the castable ball attachment patterns. **Figure 4.** Castable spherical pattern after molding with autopolymerizing acrylic resin. **Figure 5.** Cementation of the cast ball attachments with Panavia F resin cement. **Figure 6.** Ball attachment extension cut-off after cementation. **Figure 7.** Cast ball attachments after polishing. **Figure 8.** Matrix attachments with a rubber spacer placed on the cast ball attachments prior to pick up. **Figure 9.** Matrix attachments incorporated to the maxillary complete denture with hard chairside reline acrylic resin. **Figure 10.** Installation of the maxillary implant-supported overdenture and full arch fixed mandibular implant-supported/retained prosthesis. **Figure 11.** Panoramic radiographic after cast ball attachment cementation.

ing that his maxillary complete denture was unstable. The patient had been wearing a relined bar/clip overdenture in the mandible on 4 external-hexagon dental implants and a relined maxillary overdenture over 4 internal-hexagon implants without attachments system. The attachment system used in the maxillary overdenture was a ball attachment, but due to the abutments screw fracture inside the implants, the attachment system was loose, and a denture base acrylic resin had been used to provide a minimal retention. The implants were placed approximately 20 years ago. After clinical and radiographic evaluations (Figures 1 and 2), 1 implant in the left premolar region of the maxilla showed a peri-implant abscess, mobility, and loss of osseointegration, and it was removed manually. The others maxillary dental implants had marginal bone loss, however, without compromising their osseointegration.

Considering the patient's age and health, in addition to the patient's refusal to undergo additional surgical procedures, the proposed treatment was to fabricate a maxillary implant-supported overdenture using cast ball attachments. The remaining maxillary dental implants (Serson Implant, São Paulo,

SP, Brazil) did not possess attachments compatible with current systems due to configuration changes over time by the manufacturer to the dental implant's platform and components. Therefore, castable spherical patterns and ball attachments (Conexão Sistemas de Prótese, São Paulo, SP, Brazil) were used. The mandible rehabilitation was performed using 4 osseointegrated dental implants with a fixed implant-supported prosthesis. Another relevant aspect was that other prosthetic components were not compatible with the old implants in the maxilla. The aim for this treatment planning was to preserve the old maxillary implants, avoid additional invasive procedures, and rehabilitate the patient with a less complex and time-consuming therapeutic alternative.

All procedures for the fabrication of a conventional complete denture in combination with a fixed implant-supported prosthesis were used. For the fabrication of the cast ball attachments, the internal threads of the implants were ground using a diamond bur (Figure 3). Next, the inside of the implants were isolated with petroleum jelly, and castable spherical patterns were used to mold the inside of the implants (Figure 4) with autopolymerizing acrylic resin (GC pattern, GC America, Chicago, Ill). A casting alloy of silver-palladium (Ag/Pd) was used to cast the custom attachments (Alba Lite, Jelenko, NY).

After casting, the cast ball attachments were clinically evaluated, and periapical radiographs were made to ensure complete seating on the implants. The post of the cast ball attachments was sandblasted with 50-μm aluminum oxide particles. After ultrasonic cleaning and drying, a thin metal-primer layer (Alloy Primer, Kuraray Co Ltd, Osaka, Japan) was applied on the adhesive surfaces of the attachments and also inside of the implants, leaving them to dry for 5 seconds as per the manufacturer's instructions. For cementation, equal amounts of A&B paste (Panavia F cement, Kuraray Co Ltd) were dispensed, mixed for 20 seconds, and applied inside the implants by means of a Centrix syringe (Centrix Inc, Shelton, Conn; Figure 5). Next, the cast ball attachment was positioned, excess cement was removed, and the margins were light-cured for 20 seconds. After cement polymerization, the complete seating was verified with periapical radiographs, and the extensions of the cast ball attachments (used for handling them) were cut off with a diamond bur (Figure 6). Finally, the tops of the attachments were finished and polished with rubber points (Kit Polishing for Porcelain and Metals 8090d, KG Sorensen, São Paulo, Brazil) to obtain smooth, shiny surfaces (Figure 7).

The mandibular fixed implant-supported prosthesis was inserted, and the maxillary complete denture was worn in the inner region of the installation of the matrix attachments. The matrix attachments were placed on the cast ball attachments with a rubber spacer between them to prevent possible leakage of the resin acrylic on the attachments (Figure 8). The matrix attachments were picked up with a specific hard chairside reline acrylic resin (Tokuyama Rebase II, Tokuyama Dental Corporation Inc, Tokyo; Japan) within the maxillary complete denture (Figure 9). The patient was instructed to keep the teeth in occlusion and after polymerization of the acrylic resin, the denture was removed, with excesses ground and polished. Figure 10 shows the insertion of both prostheses after completion of the treatment.

After insertion, the prosthesis was evaluated for retention, stability, and phonetic and occlusal relationship with the mandibular fixed implant-supported prosthesis. Oral hygiene and home care instructions were given to the patient. The cast ball attachments were examined and showed adequate clinical and radiographic characteristics (Figure 11). The patient reported being satisfied with the treatment.

Discussion

Overall, compared with conventional complete dentures, an implant-supported overdenture has better retention and stability and increases patient satisfaction.[1] Furthermore, long-term studies (over 9 and 15 years) have demonstrated that overdentures are cheaper to fabricate and maintain when compared to fixed implant-supported prostheses.[9] Another advantage of implant-supported overdentures is easy access for cleaning; this is particularly important considering older patients with limited manual dexterity and difficulty in maintaining oral health.[10]

Prosthetic complications may occur over time in implant-supported overdentures. Such complications include implant fracture, wear or corrosion of the retention elements, fracture of the retention elements or superstructure, abutment fracture, abutment screw loosening or fracture, attachment screw loosening or fracture, activation or changing of the clip, matrix activation or replacement, rebasing or relining of the overdenture, and overdenture fracture.[3] The lack of compatible prosthetic components may also be an important limitation during the oral rehabilitation with old implants.

In this case, a maxillary implant-supported overdenture was made for 3 implants. Cast ball attachments were used as an alternative treatment due to the lack of prosthetic components compatible with the old osseointegrated implants. Thus, the implants were preserved, and the oral rehabilitation of the patient was performed in a conservative and less time-consuming manner.

The number of implants necessary to support a maxillary implant-supported overdenture varies from 2 to 8 implants.[11] Overdentures with 4 to 6 implants using a bar/clip attachment have demonstrated good functional results.[9,11] In the case of 4 implants and ball attachments, the implant survival rate was 95.2% per year.[12] For 2 implants, the cumulative implant survival rates after 7 years of loading were 75.4% in the maxilla, whereas there were no differences in implant survival rates between the ball and bar attachment systems.[13] In the present clinical case, the use of 3 implants was enough to provide retention and stability to the prosthesis.

The surface of the restorations can be chemically treated using tin plating, silicoating, or by application of metal primers to improve the cement's bonding strength to the metal substructure.[14,15] Abreu et al[16] observed that application of a metal primer (Alloy Primer) significantly enhanced the tensile bond strength of the resin cement to the base and noble metals used in the restorative area. According to a recent study,[14] the application of the Alloy Primer can enhance the retentive strength of metal copings luted with Panavia F 2.0. In

addition, some authors reported that Panavia and titanium alloys exhibit higher bond strength than do other alloys.[17,18] For this reason, in the present study, the Alloy Primer/Panavia cement was used on both adhesive surfaces, cast ball attachment posts and dental implants.

The material selection is another important factor that must be considered during the manufacture of cast ball attachments for outdated implants. Galvanic corrosion occurs when two dissimilar alloys are placed in contact within the oral cavity or tissues.[19] According to Geis-Gerstorfer et al,[20] the galvanic corrosion of implant/suprastructure systems is important in two aspects: First, the possibility of biological effects that may result from the dissolution of alloy components and, second, the current flow that results from galvanic coupling could lead to bone destruction. Some studies[19,21–23] have concluded that when titanium (Ti) is coupled with a low corrosion resistance alloy, this alloy might be subject to galvanic corrosion. Conversely, when Ti was couple with high corrosion-resistant alloys, a stable and passive combination was produced.[19] A study[19] showed that silver-palladium (Ag/Pd) alloy generated low galvanic corrosion when used with a Ti implant, and it was recommended for use as a suprastructure alloy. Therefore, a casting alloy of silver-palladium (Alba Lite) was used in this case report.

In case of highly angulation implants, some case reports[24–26] describe the use of a dental surveyor and a combination of castable components (UCLA abutment with a ball or locator patrix) to correct nonparallel implants during the manufacture of custom-made cast attachment for overdenture on a stone cast (indirect technique; performed in a prosthetic laboratory). Further, according to Nunes et al,[27] alignment devices on the patrix with variable angulations could be used to diminish the lack of the parallelism between the implants during the pickup of the matrix. However, these case reports did not consider the lack of available compatible prosthetic components for the osseointegrated implants.

In this case report, the internal threads of the implants were ground, and castable spherical patterns were used to mold the inner part of the implants with autopolymerizing acrylic resin (direct technique for the manufacture of custom-made cast attachment for overdenture performed directly in the mouth of the patient). This technique differs from others because it is an alternative in cases of osseointegrated implants without compatible prosthetic components and by using a single castable component. In addition, small corrections can be made if necessary during the molding of the inner part of the implants, improving the position of the attachments. In addition, some studies[28,29] showed that implant angulation up to 12° between implants does not seem to have a significant effect in retention forces when a ball attachment system was used. Therefore, in our case, a custom cast ball attachment was used to manage the angulation of one implant.

The limitation of this technique is that the attachment system cannot be replaced once cemented on the implant.[8] The wear or fracture of the abutment over time could hinder the replacement of the abutment, compromising the restoration.[8] In addition, the position of the implants, the interocclusal space, and the thickness of the prosthesis must be evaluated because these aspects influence the correct selection of the attachment system.

Conclusion

Considering the patient's age and health, in addition to the patient's refusal to undergo additional surgical procedures, the use of cast ball attachments on the maxillary dental implants avoided invasive procedures on the remaining implants. Furthermore, considering the lack of available compatible prosthetic components for the osseointegrated implants, this technique was considered a viable and satisfactory treatment option.

Abbreviations

Ag/Pd: Silver-palladium
Ti: Titanium

Note

No potential conflict of interest relevant to the present article was reported.

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