Clinical Reports

Implant Overdenture using the Locator System and the Gothic Arch Tracer in a Mandibular Edentulous Patient: A Clinical Report

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Abstract

Patients restored with the mandibular complete denture were often faced with complications of poor stability and retention of the prosthesis. Two implants overdenture is recognized as a standard treatment method for the edentulous mandible. In a 64-year-old man who represented severe mobility in all remaining teeth, the maxillary complete denture and the mandibular implant-retained overdenture were planned after extracting all the remaining teeth. Two implants were placed in mandibular both canine regions. To fabricate the denture, final impression was taken using a duplicate of the existing temporary denture. It is difficult to guide the mandible into the centric relation position in some denture patients. The Gothic arch tracer was used for accurate centric relation record. For conjunction with dental implants, locator attachments were used.

Keywords: Denture precision attachment, Gothic arch tracer, Implant overdenture

I. Introduction

Patients wearing complete dentures are frequently suffered from problems of poor retention and instability of the denture, low chewing efficiency, and pain during mastication. Several clinical reports have described that these complications may be successfully improved by implant-retained or implant-supported dental prostheses.¹-³ According to McGill consensus statement, two implants overdenture is recognized as the standard treatment of edentulous mandible and the evidence exists. Many studies have demonstrated that implant-retained overdenture in mandible provides improvement in retention, stability, chewing efficiency, biting force, quality of life, and patient satisfaction.⁴-⁷ Because of the smaller prosthesis space requirement, ease of cleansing,
lower technical sensitivity, and more economical advantages, solitary type have been preferred to bar type attachments. Compared to other solitary type attachments, locators are required smaller space, dual retention structure (the outer and inner contact surfaces between female and male parts) and higher retention force. Additionally, locators are self-aligning, compensation for up to 40° implants axial discrepancy is possible and could be easily repaired and replaced.

It is not easy to induce the mandible into the centric relation position for some denture patients resulted from the wrong habitual closure due to inadequate dentures, trismus, or temporomandibular joint abnormalities. Several methods of manipulating centric relation have been demonstrated in the literature. The Gothic arch tracing is the one of those methods. It is reported that it could produce a precise and reproducible centric relation record. This study demonstrates the application of a Gothic arch tracer and locator attachments for fabrication of the maxillary complete denture and the mandibular implant-retained overdenture.

II. Case report

A 64-year-old healthy man visited the Ajou University Dental Hospital for treatment of his maxillary complete denture and mandibular removable partial denture. All the remaining teeth had severe mobility (Fig. 1). After extracting of all the remaining teeth, maxillary complete denture and mandibular implant-retained overdenture were planned. There was no problem of medical history for implant placement.

Fig. 1. Intraoral photo taken at first visit.
An impression was taken using alginate impression materials (Aroma Fine Plus Normal set, GC, Japan) for the fabrication of an immediate temporary denture. The record base and occlusion rim was produced, contoured for phonetics, esthetics, and determined vertical dimension of occlusion. The Gothic arch tracer (Gnathometer M type 2, Ivoclar Vivadent, Germany) was attached to the record base and occlusion rim so that the central bearing pin was located in the center of the tracing plate. The pin was adjusted for lightly touched on the plate. Wax of occlusal rim was removed until the central bearing point was the only contact between the mandibular and maxillary record bases. Record bases were placed intraorally and instruction of mandibular movements to the patient was necessary to record a Gothic arch tracing. After the patient has described a well-defined Gothic arch, a dimple was made in the recorded plate at the apex of the arrow for maintenance in centric relation during a record was being made. In this way, the interocclusal record of centric relation was obtained using the Gothic arch tracer. A temporary denture was prepared and the remained teeth were extracted and followed by the immediate placement of the internal submerged type implants on #33 (4.0 mm × 11.5 mm; AR System, Biotem, Seongnam, Korea) and #43 (4.0 mm × 10.0 mm; AR System, Biotem, Seongnam, Korea). Two mandibular implants in both canine regions were surgically placed following the manufacturer’s protocol, and final implant insertion torques, greater than 30 Ncm were achieved (Fig. 2, 3). A healing abutment, measuring 4.5 mm in diameter with 5 mm in height (HAA455S, Biotem, Seongnam, Korea) on #33 and 4.5 mm in diameter with 7 mm in height (HAA457S, Biotem, Seongnam, Korea) on #43, was tightened onto the implant. The temporary denture was relined by a tissue conditioner (Visco-gel, Dentsply, Germany) and placed.

![Fig. 2. Placement of implant fixtures (AR system, Biotem, Seongnam, Korea).](image)

Fig. 3. Panoramic view after placement of implant fixtures.


Fig. 4. Upper and lower temporary dentures were duplicated with acrylic resin to use as a custom tray.


Fig. 5. The interocclusal record of centric relation was checked using the Gothic arch tracer with the vinyl polysiloxane bite registration material and the horizontal incisal line was marked using bonding brush.

3 months after implant placement, a new set of temporary dentures for custom tray was duplicated to precisely represent definitive prosthesis occlusion. The maxillary and mandibular temporary denture was duplicated in acrylic resin (Orthodontic Resin, Dentsply, USA) (Fig. 4). Final impressions were taken with the polyether impression material (Monophase, 3M ESPE, Germany) after border molding with modeling plastic impression compound (Peri Compound, GC, Japan) using a custom tray duplicated of the temporary denture. Wash impressions were taken by closed mouth functional impression technique. In this case, temporary denture was duplicated as a custom tray, for appropriate horizontal relation and vertical dimensions, jaw relations were recorded. The patient was asked various functional movements of closed mouth such as Gothic arch tracing in the pre-recorded vertical dimension. Functional movements were depicted by the patients. The interocclusal record of centric relation was checked using the Gothic arch tracer with the vinyl polysiloxane bite registration material (Futar D, Roydent, USA) and the horizontal incisal line was marked using bonding brush (Dental Lab Disposable Micro applicators Brushes, Dental supply in, China) (Fig. 5).

The stone cast was mounted in a semi-adjustable articulator (Stratos® 300, Ivoclar Vivadent, Germany) (Fig. 6). Acrylic artificial teeth (SR Vivodent, Ivoclar Vivadent, Germany) were set on the semi-adjustable articulator. For ideal tooth set-up with a dorsal increase of the occlusal plane in models according to the Spee and Wilson curves into account, a setting-up template was used (Fig. 7).

Wax dentures try-in were done in the mouth. Fit, esthetics, retention, stability and support were evaluated finally. For the improvement of retention, the relining impression of the maxillary complete denture was made with the polyether impression material (Monophase, 3M ESPE, Germany) and the
closed-mouth technique with an occlusal inter-digitation using the maxillary wax-denture (Fig. 8).

The midline was corrected. The setting of acrylic artificial teeth was also corrected. Final prostheses were fabricated by the heat curing system. Curing definitive denture and laboratory remounting was performed, but was not grinded because of balanced occlusion (Fig. 9-11).

Fig. 7. Ideal tooth set-up with a dorsal increase of the occlusal plane in models according to the Spee and Wilson curves.


Fig. 8. Relining impression of the maxillary complete wax denture with the polyether impression material (closed-mouth technique with an occlusal interdigitation).

**Fig. 9.** Definitive dentures.


**Fig. 10.** Intaglio surface of upper denture.


**Fig. 11.** Intaglio surface of lower denture.

The definitive denture was delivered in patient oral cavity. The retention, stability, and esthetic was evaluated and denture was shown to be properly fabricated (Fig. 12, 13). The healing abutments were taken off and hand-tightened in a clockwise direction. Mobility, clinical signs of infection, pain and radiographic bone loss were not shown, and the implants were convinced to be osseointegrated. Abutments of 4 mm cuff height on #33 (HG Locator® Abutment; Standard, Zest Anchors, USA) and 5 mm on #43 were tightened to 30 Ncm on both implants. The blue male part (Liner, Zest Anchors, USA) of the locator was then incorporated into the overdenture with a direct technique using an auto-polymerizing pattern resin (Pattern Resin LS, GC, America). The overdenture was polished and then inserted in the mouth, and minimal adjustments were taken to the occlusion and fit. The patient was instructed prosthetic maintenance and oral hygiene. At a 1-year follow-up after treatment, the patient remained satisfied with his treatment choice and its effect on his masticatory efficiency and quality of life.

Fig. 12. The definitive denture was placed in the oral cavity.

Fig. 13. Extra-oral view of lip support. Before (left) and after (right) treatment.
III. Discussion

Implant overdenture treatment can provide the appropriate support, retention and stability of the denture, and restored functions and esthetic such as lip support and phonation via a denture flange. When planning a bar attachment, the inter-arch distance has to be evaluated. Pasciuta et al. described that minimum 14 mm inter-arch distance was required when considering artificial teeth, denture base, bar thickness, and the hygienic space from the bar to the mucosa. When the inter-arch distance is insufficient, the bar attachment may resulted in over-contour of the denture, fracture of the denture, or poor oral hygiene. When bar splinting attachments is considered for retention, the resilient type ERA attachments, and different direction multiple clips, the rigid type friction pin, and swivel latchet have been used previously. Retention loss is the problem in such attachment caused by wearing during the repeated removal and insertion of the denture. In that case, plastic male parts may be changed. However, metal female parts are required to re-manufacture. To avoid this situation, the locator attachment system can be selected. It allows 0.2 mm vertical movement and durable. The locator is easy to use and post-treatment complications are less. Special technical training is not required. The reported satisfaction of the patient is quite high. In the majority of the attachment systems, reduction or total loss in retentive force was found. The wear patterns and related deformations of attachment during the mastication are different from during insertion-removal procedure. Denture rotation around the attachments resulted from displacing mucosa under the base of the denture when occlusal loads are applied. The resiliency of attachments is determined by the amount of transmitted loads to the attachments from occlusal loads. For reducing the denture movement and, thereby, also reducing the forces on the implants, an optimal stress distribution is important. The locator retentive force is decreased down to 40% of its full retentive values when simulated mastication with a non-linear descending curve. The nylon parts were severely worn. This represents maintenance correlated with mastication is needed for locator system.

For the successful restoration in edentulous patients, the appropriate centric relation record is required. The wear and the deformation of attachment can be reduced by accurate centric relation. The retentive force is also maintained for a long time, relatively. A precise centric relation record can be obtained using the Gothic arch tracer. In addition, for the accuracy of the Gothic arch tracer record, stable record bases are prerequisite. Especially in the Gothic arch tracing technique, inaccuracy could be resulted from any movement of the record bases during recording of centric relation. The closed mouth functional impression technique was used and interocclusal record of
centric relation was checked using Gothic arch tracer simultaneously, contribute to stabilize bases, and thereby minimize movement of bases during the tracing and mounting procedures.

IV. Conclusion

This clinical report describes complete denture in the maxilla and the implant overdenture using the locator system in the mandible for edentulous patient. For accurate centric relation record, the interocclusal record was obtained using the Gothic arch tracer.

References


