Technical Introduction

Advantages of a New Type of Riegel Attachment

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Clinical significance
The article describes the Suginaka riegel, which is much easier than the original riegel attachment to use. The Suginaka riegel is less complicated, which makes laboratory operations easier. An abutment tooth can be protected from non-physiological forces because of the latch. The Suginaka riegel can be widely applied to many clinical cases.

ABSTRACT

Purpose: There is a wide variety of patterns for retainers used in partial dentures. In these patterns, most of the retentive mechanisms apply friction, mechanical interlocking force or resilience. In contrast to these methods, there is a mechanical retention system that utilizes a retentive projection to latch onto another projection without applying any force. This system is the riegel precision attachment. However, a more complicated technique using high-precision devices is required to fabricate this riegel precision attachment, which is more troublesome to work with during laboratory operations. The new Suginaka riegel system was designed to facilitate laboratory operations and simplify laboratory processes and clinical handling.

Methods: The Suginaka riegel consists of a sheath case in which an easily retractable lever is placed in advance. The retentive section of the lever is connected to a projection on an abutment tooth. The denture is inserted or removed from the mouth by protracting or retracting the lever.

Results: The Suginaka riegel can avoid the most difficult laboratory process of incorporating the lever that retracts or protracts the hook smoothly, such as is found with the conventional riegel attachments. Because it is different from retainers that apply friction or interlocking force and resilience, no prosthetic injuries are sustained by the abutment tooth even during functioning and placement or removal of the denture because no detrimental force was applied to the abutment tooth.

Conclusion: The use of the Suginaka riegel simplifies laboratory processes, and the latch mechanism works reliably without the necessity for complicated laboratory techniques.

Key words
riegel, retainer, latch effect, simplifying laboratory processes, abutment tooth protection
INTRODUCTION

In general, retainers for partial dentures must be constructed so that they can achieve the three functions of bracing, support and retention\textsuperscript{1–4}. The retentive function of most retainers is accomplished by means of friction, interlocking force or resilience\textsuperscript{5–8}. However, another alternative is to use mechanical retention provided by a retentive projection. This alternative to traditional methods of retention, the riegel precision attachment\textsuperscript{9,10} makes use of the "latch effect." Using a latch is certainly reliable in terms of retention; the abutment tooth is never harmed as sometimes happens with other types of retentive attachments. However, a more complex technique using a high-precision device called a parallelogram is required to make the riegel precision attachment. Because of the more complicated and time-consuming preparation before use, these attachments have not been widely used. Thus, the Suginaka riegel (HIGH-DENTAL • JAPAN, Osaka, Japan) was designed by incorporating the main advantages of the riegel, i.e., the use of a latch for retention and simpler laboratory operations. The result was an attachment that is easy to handle clinical without the difficulties of adjusting the lever\textsuperscript{11} (Fig. 1).

CONSTRUCTION AND DIRECTIONS FOR USE OF THE SUGINAKA RIEGEL

The Suginaka riegel consists of an L-shaped lever attached to a rotating axis at one end. At the other end, there is a hook that protracts and retracts within a 20° range. The angle region of the lever with an exposed hook serves at the retentive mechanism (Fig. 2). Both the lever and sheath case are made of gold-platinum alloy.

The Suginaka riegel is used as follows:

It is placed in a denture base without soldering and is brought into contact with a rod projection (1.2–1.5 mm in diameter) provided on an abutment tooth or a slit provided in a plate projection (2 mm in thickness) (Fig. 3). Either of these two projections is fabricated using one-piece casting for the restoration of an abutment tooth (class II inlays, MOD inlays, 3/4 crowns, 4/5 crowns, full cast crowns, resin-facing crowns or porcelain-fused-to-metal crowns, etc.). However, this one-piece casting is made with a projection on the inner crown when an abutment tooth is a telescopic crown (Konus crowns or CSC crowns, etc.) (Fig. 4). It is important to leave a slight clearance in the contact region between each projection and the inside surface of the denture to keep the denture from contacting each projection because of the mobility of the denture during functioning.

As for the plate projection, since the transmission of the functional force from the denture to the abutment tooth causes excessive load to the abutment tooth, a slight clearance is needed to keep the lever from contacting the inferior margin of the slit in the plate projection. There-

![Fig. 1 The Suginaka riegel (HIGH-DENTAL • JAPAN)](image)

![Fig. 2 Size and construction of the Suginaka riegel](image)
fore, a slit slightly wider than the thickness of the lever should be prepared (Fig. 5).

With this projection and the Suginaka riegel covered by an artificial tooth, a metal tooth is used to prevent fracture of the artificial tooth that could occur if the space between the projection and antagonist teeth is too narrow.

The hook can be set either buccally or linguually, and the area where the projection for the hook is located should be aligned in the interdental area between the abutment tooth and metal tooth.

In placing the Suginaka riegel into the denture base, a thin film of wax is applied in advance between the sheath case and the lever so that resins do not get into the sheath case. The retentive portion of the Suginaka riegel is enclosed in the inside surface of the metal tooth using self-curing resin; it (the retentive section) is brought into contact with the lower margin of the rod projection or the upper margin of the slit in the plate projection. After curing, the base resins are finished after confirmation that the lever can protract and retract easily.

When the base resin has finished curing, the hook is polished and completed in the same way as the surface with the projection of the hook is polished.

When using the plate projection, there is no problem using the Suginaka riegel for unilateral free-end missing teeth. When using it for bilateral free-end missing teeth, the presence of two plate projections inhibits depression of the denture by distributing occlusal stress evenly between the two plate projections. A unilateral configuration may result in distorted force being transmitted to both of the abutment teeth and
causing prosthetic injury. To compensate for this imbalance, it is important to make a somewhat greater clearance between the axial wall of the plate projection and the inside surface of the denture (Fig. 6).

DIFFERENCE FROM CONVENTIONAL METHOD

Laboratory processing of the conventional riegel precision attachments requires accuracy from all aspects and should be completed so that the lever can be protracted and retracted smoothly in the casting. This processing is the most difficult characteristic of the riegel, and precise techniques are required. However, with respect to the Suginaka riegel, there is no need to conduct these laboratory processes since the lever is placed within the sheath case in advance and is designed to be smoothly protracted and retracted. It is only necessary to bring the retentive part of the lever into contact with the rod projection, or the slit in the plate projection, and there is no need to solder anywhere. The only precaution is that resins should be prevented from getting into the sheath case when curing denture base resins.

EFFECTS AND PERFORMANCES

The Suginaka riegel can achieve mechanical retentive retention through latching as effectively as the conventional riegel precision attachments do. Application of the Suginaka riegel cases is limited to upper or lower lateral incisors on which the retentive projections can be provided and upper or lower canines in which the hook can be placed. The Suginaka riegel is also available for situations where two or more teeth are missing. The hook may be directed either buccally or lingually, and should be placed where the attachment will take it easily, with the surrounding areas finished in the same way as the polished surface of the base. This prevents the tongue from being injured.

Esthetically, the hook should be directed to the lingual side. However, when the retentive projection is placed at the mesial surface of a posterior molar with two or more missing anterior teeth, the hook should be directed to the buccal side to protract the lever (Fig. 7).

The retainer with the mechanisms of both bracing and support should be designed on an abutment tooth since the Suginaka riegel supplies the retentive function only. With a Konus or CSC crown used on an abutment tooth, the inner crown is provided with a projection. However, there is no problem since both mechanisms of bracing and support have already been provided for the outer crown (Fig. 8). On the other hand, a retainer supplying both bracing and support should be designed with an abutment tooth provided with a projection using an inlay or a crown (Fig. 9). The integration of the retainer with the denture provides rigid support$^{12-14}$. Although the large area that is braced signifi-
Fig. 7 When a projection is provided at the mesial surface of the posterior molar, the hook of the Suginaka riegel is directed to the buccal side

Fig. 8 Example of a plate projection for free-end missing teeth (#19 and #18)
A) The resin-facing crown on #21 is connected to the Konus inner crown with a plate projection on #20
B) The outer crown on #21 is a partial coverage type of 4/5 crown, #20 is a facing type of a Konus outer crown and #19 is a facing type of metal tooth. The outer crowns on #21 and #20 are integrated with the denture
C) No friction is applied to the inner and outer crowns on #21 and #20, which are fitted loosely. The outer crowns on #21 and #20 are provided with both bracing and support
D) Buccal view of setting

Fig. 9 Example of a rod projection for free-end missing teeth of #20, #19 and #18
A) Class II inlay with a rod projection set on #21
B) Unilateral denture. A ring clasp with a rest on #21
C) Ring clasp was used to provide sound #21 with bracing. Lingual rest on #22. A facing type of metal tooth on #20
D) Lingual view of setting

Significantly contributes to the stability of the denture, bracing by means of friction directly transmits the functional force of the denture to the abutment tooth and may force the abutment tooth beyond its physiological limit of mobility and may result in exceeding the functional force-bearing limit of the abutment tooth. Therefore, the retainer should not be tightly braced against the abutment tooth but should be slightly loose. This looseness allows the design based on the concept of rigid support for short-span free-end saddle partial dentures to adapt and helps protect the abutment tooth (Fig. 10).

Konus crowns provide retention by applying friction to the originally inclined axial surface. However, the use of the Suginaka riegel eliminates the need for applying friction to the inner and outer crown to avoid and allows them to fit loosely. This can completely eliminate the occurrence of problems such as detachment of the inner crown, detachment of both the inner crown and core, or difficulty in placing and removing the denture.

The use of the Suginaka riegel allows the denture to be placed and remove without jarring the abutment tooth. The lever can be protracted and released without applying friction or other force. Furthermore, with two types of projections set to keep contact from the metal tooth and
Physiological mobile range of abutment tooth +
Clearance from looseness between the inner and outer crown
> The amount of depression of denture

Fig. 10 Advantage of the outer crown fitted into the inner crown loosely
Cases for the short free-end saddle are not adaptable from the concept of rigid support. However, rigid support can be achieved even in short free-end saddle partial dentures since the physiological mobility and clearance from looseness between the inner and outer crowns allows depression of the denture.

the inside surface of the denture, no functional force of the denture is transmitted to the abutment tooth, and excessive load of the abutment tooth never arises. Thus, the abutment tooth can be protected during placement or removal of the denture.

CONCLUSION

Since the retractable lever (which is the most difficult part to fabricate) is prefabricated in the Suginaka riegel, it is only placed in a plate so as to connect to a retentive projection. Therefore, the use of the Suginaka riegel makes laboratory operations easier compared to the conventional riegel attachment, since very precise devices are not needed; laboratory processes are simplified and smooth movement of the lever is achieved, leading to an decrease in cost.

REFERENCES