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Modified Split Pontic As Non-Rigid Connector: A Stress Breaker For A Pier Abutment (A Case Report)

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Abstract:
In long-span fixed partial denture restoration, mainly in case of pier abutment, a non-rigid connector which act as a stress breaker is indicated. The Non-rigid connector can be of dovetail , loop connector, split pontic, cross-pin and wing. A split pontic is an attachment placed entirely inside the pontic, particularly indicated in the tilted abutment case, to prevent the box preparation of the distal pier abutment. This case report presents the use of a split pontic as a non-rigid connector, in combination with a dovetail attachment, to provide a reliable and long-lasting restoration for pier abutment cases. This design not only prevents the pier abutment from acting as a fulcrum but also provides better aesthetic outcomes with minimal tooth reduction. It minimizes mesiodistal torquing of the abutment teeth, allowing individual tooth movement.
The use of non-rigid connectors is essential in pier abutment cases. Split pontic, as a non-rigid connector, provides numerous benefits in terms of stress distribution, preservation of abutment teeth, and aesthetic outcomes. Therefore, the Longevity and success of fixed partial denture restoration depend on the size, shape, type, and connector position. In pier abutment cases, split pontic can be considered as one of the treatment choices to restore the missing teeth and preserve the abutments

Keywords: *pier abutment, stress breaker, split pontic, non-rigid connector*

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I. INTRODUCTION:

Replacement of missing teeth with a fixed dental prosthesis involves careful consideration of the biomechanical principles in designing the prosthesis. Partial edentulous conditions due to caries, trauma, or periodontal problems is commonly seen. The design of a fixed dental prosthesis takes into account the biomechanical principles involved in supporting the restoration. The restoration must be stable, functional, and aesthetically pleasing. The clinician must consider the patient's occlusion, the type of abutment teeth available, and the material of the prosthesis. Additionally, proper oral hygiene must be maintained to ensure the longevity of the restoration.[1]

The connector is an important component of a fixed partial denture, as it connects the pontic (the artificial tooth) to the abutment teeth (the natural teeth that support the restoration). The rigid connector is commonly used because it provides the best stability and minimizes stresses on the supporting teeth. However, in cases where a pier abutment is present (meaning that there is only one natural tooth between the edentulous spaces), a rigid connector is not recommended. This is because it can lead to excessive stress on the pier abutment, which can cause damage over time.[1] In these cases, a non-rigid connector, such as a semi-precision attachment, is often used to distribute the forces more evenly.

According to the Glossary of Prosthodontic Term 9, pier abutment or intermediate abutment is defined as a 'natural tooth or implant abutment that is located between terminal abutments that serve to support a fixed or removable dental prosthesis. [3]

In pier abutment cases, the teeth in different segments of the arch move in different directions due to the curvature of the arch. This is because an anterior tooth's faciolingual movement occurs at a different angle

compared to the molar segment's faciolingual movement.[2,4] These measurable magnitude movements and divergent directions can create stresses in a long-span prosthesis. As a result, the forces generated by the occlusion may not be distributed evenly throughout the arch, leading to stress concentration on the pier abutment. The Pier abutment will act as a fulcrum generating tensile force between the retainer and abutment teeth at the other end. The anterior or posterior abutment will experience extrusive forces during fulcrum action, and resultant tensile strength at the retainer to abutment interface leads to debonding of the prosthesis due to marginal leakage of the restoration and caries.[5,6] This is why it is important to carefully consider the design and choice of materials when restoring a pier abutment case to minimize the risk of damage and ensure the longevity of the restoration.

Treatment choice in cases where a pier abutment is present, a dental implant, or a fixed movable bridge with a non-rigid connector using precision or semi-precision attachment may be used to restore the missing teeth. A fixed movable bridge with a non-rigid connector can act as a stress breaker, preventing the transmission of stress from the retainer to the pontic and reducing the risk of damage to the pier abutment.[2,6]

The non-rigid connector mainly used is the T-shaped(key) placed at the pontic and dovetail (keyway) at the retainer tooth.[2] This type of connector usually has metal exposure on the occlusal surface. It can impair the aesthetic of the restoration.

A split pontic is an attachment that splits the pontic and acts as a stress breaker. It is used in tilted abutment and pier abutment cases. The use of a conventional dovetail would necessitate the preparation of a very drastic box in the distal aspect of the pier abutment.[2] This case report presents the treatment of a pier abutment case with a fixed movable bridge using a dovetail-shaped attachment assembling split pontic as the non-rigid connector to overcome the mechanical factor in the pier abutment case and to achieve aesthetics.

II. CASE REPORT:

A 52-year-old male patient reported to the Department of Prosthodontics of College of Dental Sciences, Davangere, India, with a chief complaint of difficulty in chewing due to multiple loss of teeth and wanted to replace the missing teeth.

The dental history of the patient reveals that he had undergone extraction of his teeth six months back due to caries and wants to replace them. Intraoral examination showed that missing teeth irt 21, 24, and 26, 27 (figure 1).

Abutment tooth 23 has cervical caries and has been restored with GIC cement. The occlusal scheme of this patient is group function (Figure 2). Radiographic analysis showed that all the abutment teeth have crown-to-root ratio of 2:1, with good periodontal support, and no pathologic lesion.

The treatment choice offered to the patient is a dental implant or a anterior 3 unit bridge with a non-rigid connector. After a thorough discussion with the patient, he has decided to replace his missing teeth with a porcelain fused to metal fixed removable bridge with a non-rigid connector because it's feasible.

Figure 1 : Intra oral image (pre-op)

Figure 2 : occlusal scheme left and right side

Clinical procedure:

Diagnostic impressions were made, and diagnostic mounting was done with the help of protrusive and lateral bite records, and tentative jaw relation.

Abutment teeth 11, 22, 23, 25, 28 were prepared to receive porcelain fused to metal crowns (figure 3). Anterior abutment teeth with shoulder and subgingival margins, posterior abutment teeth with chamfer and equigingival margins has been prepared.

Gingival retraction was performed, and the final impression was made with elastomeric impression materials using double stage technique (figure 4).

Figure 3 : preparation of abutment teeth

Figure 4 : final impression

Lab procedure: final impression poured by type V dental stone(high strength, high expansion) master cast has been obtained. Master cast is scanned by using a 3D lab scanner (figure 5) and designed by CAD/CAM wax (figure 6) . Abutment teeth 11, 22 has designed separately and abutment teeth 23, 25, 28(pier abutment) has designed into two segments, I,e anterior and posterior segment. Anterior segment consists of 23, 24, 25. The male component(key) is attached to distal portion of 25, pontic teeth 26 has been designed as split pontic (figure 7). Posterior segment consists of 27, 28, and female component (keyway) will unite with the male component assembling the split pontic of 26 (figure 8) . This split pontic acts as a Non- rigid connector by breaking the stress.

Metal try-in was performed in patient's mouth to check marginal fit and shade selection has done. porcelain build-up has been done to metal copings.

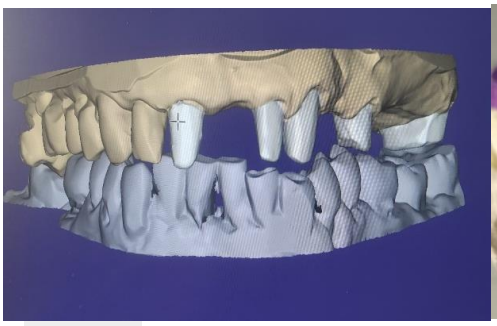

Figure 5 : 3D model scanner

Figure 6 : wax pattern design

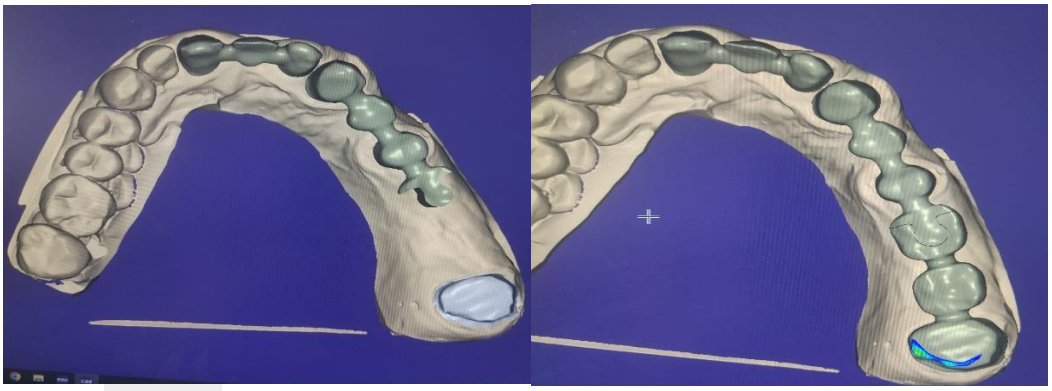

Figure 7 : anterior segment(key) with split Pontic design of 26 abutment teeth

Figure 8: posterior segment(keyway) assembling splint pontic of 26 (key)

Fixed movable bridge was checked in the patient's mouth, premature contacts were adjusted and occlusion was checked (figure 9) and cemented with GIC luting cement (type 2). During cementation, anterior 3 unit has been cemented first (11,21,22) followed by anterior segment cementation(male: figure 10) and then posterior segment(female). Intraoral image of final prosthesis (figure 11 & 12).

Post-restorative instructions were advised to the patient including oral hygiene instructions. The patient was recalled after 1 week for follow-up and to assess oral hygiene status.

Figure 9 : premature contacts were adjusted

Figure 10: cementation of anterior segment

Figure 11 & 12 : Intra-oral image of final prosthesis

III. DISCUSSION:

Conventional rigid connectors are the preferred way of fabrication of FDP because it is the rigidity of the connection between the pontic and the retainers that provides desirable strength and stability to the prosthesis while minimizing the stresses associated with the restoration. However, this solution is not applicable in all Conventional rigid connectors are the preferred way of fabrication of FDP because it is the rigidity of the connection between the pontic and the retainers gives desirable strength and stability to the fixed prosthesis while minimizing the stresses associated with the restoration. However, this solution is not applicable in all conditions , it may vary depending on cases.[1]

In pier abutment cases, the teeth in different segments of the arch move in different directions due to the curvature of the arch. This is because an anterior tooth's faciolingual movement occurs at a different angle compared to the molar segment's faciolingual movement.[2,4] These measurable magnitude movements and divergent directions can create stresses in a long-span prosthesis. As a result, the forces generated by the occlusion may not be distributed evenly throughout the arch, leading to stress concentration on the pier abutment. The Pier abutment will act as a fulcrum generating tensile force between the retainer and abutment teeth at the other end. The anterior or posterior abutment will experience extrusive forces during fulcrum action, and resultant tensile strength at the retainer to abutment interface leads to debonding of the prosthesis due to marginal leakage of the restoration and caries.[5,6]

It was previously theorized that forces of mastication are transmitted to the terminal retainers as a result of the middle abutment acting as a fulcrum, causing failure of the weaker retainer if rigid connectors are used. [8]

In such cases, a non-rigid connector can be used to allow for some degree of movement between the retainers and the pontic, thus reducing the stress on the abutments and the surrounding bone.

There are several types of non-rigid connectors, including the loop connector, the stress breaker connector, and the modified ridge lap connector.

Non-rigid connector are of different types:
a) dovetail or key-keyway
b) loop connector
c) split pontic
d) cross-pin and wing.

According to Shillinburg, the ideal location to place keyway is on the distal aspect of the pier abutment while that of the key is placed on the mesial aspect of the distal pontic.[2] The reason is that the posterior teeth have a slight mesial inclination and have been shown to move more in this direction on application of occlusal forces. Placing the keyway on the distal aspect of the pier abutment helps in preventing dislodging of the key from the keyway when occlusal forces are applied. Placing the keyway mesial to the pier abutment retainer will tend to dislodge the key from the keyway on application of occlusal forces which in time might lead to fracture of the canine retainer or bone loss around the canine abutment. Therefore, it is important to carefully consider the placement of the keyway in pier abutment cases to ensure optimal stability and longetivity of restoration.[9]

IV. Conclusion:

The selection of right type of connector is an important step for a successful treatment especially in cases of long span FPD, pier abutment cases. The conventional use of non-rigid connectors aids in compensating stress distribution on abutment teeth. for the success of long-span FPD , clinician should be aware of design and passive fit of non-rigid connectors.

Conflict of interest : None

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