

SHORT COMMUNICATION

CLINICAL CONSIDERATIONS FOR THE USE OF CANTILEVER BRIDGES

Haroon Rashid¹, Zeeshan Sheikh, ² Yuliya Mulyar³

¹Department of of Prosthodontics, Ziauddin University, Clifton, Karachi, Pakistan.

²Department of Dentistry, University of Toronto, Canada.

³ Schulich School of Medicine & Dentistry, Western University, London, Ontario, Canada.

ABSTRACT

Replacement of missing dentition is one of the common reasons to attend a dental practice for individuals who wish to restore their aesthetics and function. There are a variety of treatment modalities for the replacement of a single missing tooth that is a removable of partial denture, a fixed partial denture or an implant supported restoration. Each of these treatment options have their own advantages and disadvantages. Adequate clinical experience becomes a most important factor for treatment planning in fixed and removable prosthodontics. The cantilever fixed partial denture is defined as a restoration having one or more abutments at one end while the other end of the restoration remains unsupported. Anterior teeth replacement can be effectively done using a short-span cantilevered fixed partial denture. Studies report that conventional cantilevered fixed prostheses of various designs have a survival rate of 82% over a 10 year period and cantilevered resin-retained prosthesis show survival rates 83 92% during a 5 year period. While treatment planning for fixed cantilever bridges, there are aesthetic, design and occlusal considerations that should be kept in mind to achieve successful treatment outcome. These are discussed in this paper. Also included, is a clinical case report of a patient that had fixed cantilever prosthesis replacing the maxillary left central incisor with good aesthetic and functional results. Geriatric patients prefer the comfort of a cantilever fixed partial denture to a removable partial denture, since less maintenance is required at subsequent appointments. However, with the rapid advancement in implant dentistry, the use of cantilever fixed partial dentures may be decreasing. This article outlines the basic clinical considerations which may be applied during treatment for fixed cantilever bridges.

KEYWORDS: *Cantilever bridges; clinical treatment planning; tooth replacement; fixed prosthodontics.*

Corresponding Author

Dr Haroon Rashid

Assistant Professor,

Division of Prosthodontics,

Ziauddin College of Dentistry

Email : drh.rashid@hotmail.com

INTRODUCTION

Replacement of missing dentition is one of the important needs for patients. It is common reason to attend a dental practice for individuals who wish to restore their aesthetics and function¹. There are a variety of treatment modalities for the replacement of a single missing tooth i.e. a removable partial denture, a fixed partial denture or an implant supported restoration. Each of these treatment options has their own advantages and disadvantages¹. Several factors affect the final treatment decision for the replacement of a missing tooth and these factors are case dependent². In the majority of cases, if one treatment option is available, the

definitive replacement will largely be based on the patients' decision, gender, age, general awareness and knowledge about the specific treatment modality³. Therefore, it becomes necessary that the needs and demands of a patient are well understood so that the type of treatment provided ensures his/her satisfaction⁴. The treatment cost is also considered as a major determining factor for the patient preferring a certain treatment modality⁵.

Patient satisfaction has always been considered to be a concern while planning the treatment meanwhile the treatment options keep changing due to advancements in dentistry⁶. Since there is a wide

variety of options currently available to address the challenge of replacing a single-tooth, selecting the most appropriate treatment option for every patient can become a challenge and it is essential that all the options are carefully reviewed and discussed⁷. The main purpose however; should not only be related to the cost, time, or difficulty in performing the procedure, but should be the best possible long-term solution for each individual patient⁸. This paper describes the aspects that clinicians should consider when planning cantilever prosthesis for teeth replacement. A short clinical report for the replacement of a maxillary left central incisor using a conventional fixed cantilever bridge is also included.

REPLACEMENT OPTIONS IN PROSTHODONTICS

When missing teeth are to be replaced using either fixed or removable prosthesis and the natural existing teeth are to be considered as abutments, various factors are required to be considered⁹. For successful prosthodontic therapy, it is a requirement that certain diagnostic criteria are followed and radiographic examination, tissue evaluation and occlusal checks are performed prior to the start of the treatment¹⁰. McCord & Stales¹¹ outlined the following ideal conditions prior to the start of prosthodontic treatment:

- The abutment teeth have a sound structure and good appearance with adequate crown forms.
- Alignment and positioning of the teeth is good and there is no need of orthodontic therapy or a complex prosthesis design.
- Good endodontic and restorative therapy has been performed previously.
- Alveolar bone levels are satisfactory with good abutment tooth root form.
- Alveolar bone of the edentulous ridge is well

developed having soft tissue which is satisfactory in quality and quantity.

Assessment must always be made for the inter-occlusal space available for the prosthesis that is to be planned and it is recommended that the casts should be mounted on a semi-adjustable articulator. Orientation of the maxillary cast in an articulator is crucial, acts as a baseline from which further steps for occlusal rehabilitation of the patients are to be carried out¹². It may be necessary that the occlusal vertical dimension is raised to create sufficient inter-occlusal vertical space^{13,14}. Spaces available between the abutment teeth may be too large or too small for the pontic and in some cases, orthodontic tooth repositioning/correction may be required¹⁵.

Relative advantages and disadvantages of different treatment modalities are enumerated in

Table 1.

In many cases, the replacement of teeth may not be required at all and patients should be counseled and convinced. It has been proven that individuals can function adequately with shortened dental arches where at least four occluding premolar units are present^{16,17}. However; acceptance will largely depend on the age and symmetrical position of the teeth. Although the cost of fixed prosthesis is high, it is still the preferred option for teeth replacement^{18,19}. There are many patients who simply will not wear their removable partial dentures particularly those that do not improve the patient appearance. Retention, stability and support of an acrylic removable denture for many individuals is unsatisfactory²⁰ and overcoming these problems often becomes a challenge²¹.

Table 1: Relative advantages and disadvantages of different prostheses.

REMOVABLE PARTIAL DENTURES	FIXED PARTIAL DENTURES	IMPLANT SUPPORTED PROSTHESIS
Advantages	Advantages	Advantages
Less expensive.	Close to natural appearance.	Superior retention, stability and support.
Minimal tooth preparation required.	Superior stability during mastication.	No natural tooth preparation required as teeth are restored individually over implant supported abutments.
Long edentulous spans can be restored.	Minimal soft tissue coverage.	Any edentulous area can be restored.
Alveolar ridge tissues can be restored.	Cannot be easily removed.	Certain prosthesis types can be removed by the dentist for maintenance.
Can be removed by the patient for cleaning and maintenance.	Better patient tolerance and acceptability.	Residual alveolar ridge can be preserved.
Disadvantages	Disadvantages	Disadvantages
Clasps may have a negative aesthetic impact.	More expensive than removable partial dentures.	Costly than any other prosthetic solution.
More plaque retention.	Suitable for short span restoration.	Contraindicated for medically compromised patients.
May cause gag reflex due to bulk.	Extensive tooth preparation is a requirement.	Restorations cannot be planned due to anatomical limitations.
Abutments must have adequate alignment with good functionality.	Compromised retention and stability may be present.	Procedure often time consuming (from implant placement till the final restoration placement).

CANTILEVERED FIXED PARTIAL DENTURES

The cantilever fixed partial denture is defined as a restoration having one or more abutments at one end while the other end of the restoration remains unsupported. These are usually cemented using a suitable permanent cement and cannot be removed by the patients. Varied and extensive clinical experience is certainly of great value in treatment planning and weighing the relative merits of a particular type of restoration for a given clinical situation. Anterior teeth replacement can be effectively done using a short-span cantilevered fixed partial denture. Studies report that conventional cantilevered fixed prostheses of various designs have a survival rate of 82% over a 10 year period²² and cantilevered resin-retained prosthesis (with metal or winged ceramic retainers) show survival rates from 83-92% during a 5 year period²³. For short-span prosthesis placed in low stress situations, the survival rates would certainly be more. Adequate clinical experience is an important factor in cantilever fixed partial denture treatment planning. Although these require more time to plan, if

the necessary criteria are met, the final results can be very rewarding for the clinician and the patient from both the esthetic and a functional standpoint. While treatment planning for fixed cantilever bridges, there are certain considerations that should be kept in mind to achieve successful treatment outcome. These are discussed in the following sections.

Cantilever bridges for anterior dentition

Since occlusal forces are less in anterior quadrants, cantilever fixed partial dentures in anterior regions will be more successful provided that a normal vertical and horizontal overlap is present^{24,25}. However, anterior cantilever fixed partial dentures should be avoided when there is excessive vertical overlap. Vertical overlap causes excessive load on anterior teeth during protrusive and excursive movements²⁶. In patients who have Class III malocclusions and those individuals who exhibit excessive wear patterns on anterior teeth, cantilever bridge should be avoided where possible.

The influence of masticatory forces

In order to preserve the integrity of the periodontium and integrity of the material, it is very important that the nature of the prosthesis components are well understood. When forces are applied to a cantilevered pontic during function, they are resisted by the abutment teeth through the rotational and tilting movements rather than movements occurring along the long axis²⁷. It is recommended that two abutments should be used for a single cantilever pontic however; this will largely depend on the existing clinical condition of the oral cavity and the location of the pontic²⁸. In the posterior region, the muscles of mastication exert forces and if a cantilevered pontic is to be placed posteriorly, additional abutment teeth may be involved so that the forces may be tolerated effectively²⁹.

Occlusal considerations

The dento-gingival attachment apparatus is delicate and should be treated with care while preparing for fixed prosthesis³⁰. Extended stability with any prosthesis can be achieved by prior periodontal treatment (where required) and the development of a non-traumatizing and stable occlusion³¹. Where balancing contacts can be established, tooth migration, increased mobility and tilting can be prevented during jaw movements. If the occlusion is stable and the cantilever fixed partial denture is free of pre-mature contacts, it will only be subjected to heavy/large forces³². Group function occlusion should be preferred for patients with a cantilever prosthesis²⁹. The pontics in the posterior regions must be adjusted so that light occlusal forces are encountered by them. It is also recommended that post-operative oral hygiene instructions are given to the patients³³ with focus on cleaning of the interproximal surfaces and the areas under the pontics³⁴.

Design of the cantilevered pontic

If vertical loading over the pontics is to be reduced, the free-end pontics can be made without complete occlusal surfaces but with facings³⁵. However; it is necessary that inter-occlusal relationship is not obliterated completely otherwise over-eruption of the opposing dentition may occur³⁶. Over-eruption of teeth can create a situation that may prove to be equally as unsatisfactory as the excess occlusal force that one is trying to avoid. In situations where there is reduced mesio-distal space, better aesthetics can be attained using cantilever bridges and care should be taken that the pontic does not exert excessive pressure over the soft tissues³⁵. Provision of rests on adjacent teeth for additional support is contraindicated since there is a possibility of

secondary caries under the rests and trouble of maintaining good oral hygiene³⁷.

Mechanical considerations

During function, the abutment tooth that is farthest from the free-end pontic gets most of the impact of dislodging forces. It is a clinical recommendation that the cement should be the strongest where there are maximum forces of compression and distension and that the metal should have its maximum strength over these abutment teeth²⁸. The maximal strength of most of the luting cements is compressive whilst the minimal strength is tensile^{38,39} and it is worth mentioning that the forces acting apically direct the tensile forces to the cement of the retainer that is farthest from the cantilever⁴⁰. Excessive bending forces from the cantilevers can also modify the feedback control mechanism that comes from the periodontal mechanoreceptors and thus, magnifying neuromuscular sensitivity³².

CLINICAL REPORT

A 58-year-old patient reported to the outpatient department of the Leeds Dental Institute seeking replacement for his missing left central incisor due to trauma in **Figure 1, 2 & 3**. Patient had no remarkable medical history and soft tissue examination revealed no abnormalities. Options of tooth replacement were discussed and the benefits and drawbacks of different treatment modalities were explained to the patient. It was mutually agreed and decided that a conventional cantilever fixed bridge was to be fabricated. An initial impression was recorded using irreversible hydrocolloid (Cavex, Holland, BV). A facebow record was taken using Denar Facebow (Whipmix Corporation, USA) and the casts were mounted on a semi-adjustable articulator (Denar 2, Whipmix Corporation, USA). Tooth preparation of the maxillary right central incisor was carried out following the principles as described by Schillingburg⁴¹ with a buccal shoulder and a lingual chamfer margin. The impression was recorded with an addition cured silicone material (3M Express, 3M ESPE, St.Paul, USA) using the putty-wash impression technique followed by shade selection. Temporization of the maxillary right central incisor was carried out using Protemp™ (3M ESPE, Germany) which was cemented on the prepared abutment using Tempbond NE (Relyx™, 3M ESPE, Germany). The final fixed cantilever prosthesis replacing the maxillary left central incisor (**Figure 4 & 5**) with a good aesthetic and functional outcome was cemented using a resin-cement (Panavia F2, Kurray Dental) and the patient was given instructions to maintain oral hygiene and was recalled for periodic check-ups.



Figure 1: Pre-operative clinical photograph showing anterior view of the patient during smile.



Figure 4: Post-operative clinical photograph showing anterior view of the patient during smile.



Figure 2: Pre-operative clinical photograph showing anterior close-up view of the patient.



Figure 5: Post-operative clinical photograph showing anterior close-up view of the patient.



Figure 3: Pre-operative clinical photograph showing occlusal view of the maxillary arch.

CONCLUSION

There are several tooth replacement options in prosthodontics and all treatment options offer advantages and disadvantages. Patient awareness about the advantages and disadvantages of different treatment modalities is important during clinical decision making and thus, single-tooth replacement poses a challenge in restorative dentistry. For several years, patients were advised to place their desires aside and accept the limitations of a fixed partial denture. Geriatric patients prefer the comfort of a cantilever fixed partial denture to a removable partial denture, since less maintenance is required at subsequent appointments. With the rapid advancement in implant dentistry, the use of cantilever fixed partial dentures

may be decreasing. Replacement of teeth using dental implants offers several advantages mainly that the abutment teeth do not require preparation and thus, the risk for elective endodontic treatment, discomfort because of hypersensitivity, difficulty of access for plaque control can be avoided.

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