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CONSIDERATIONS IN CANTILEVER FIXED DENTAL PROSTHESIS

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Abstract:

The cantilever fixed dental prosthesis is a restoration with one or more abutments at one end and unsupported at the other end. Forces transmitted through these cantilevered pontics results in tilting and rotational movements of the abutments. The greatest strain in the distal cantilever fixed partial denture is recorded mesial to the most distal retainer because most fractures occur in this region. There are various criteria and factors necessary for planning a cantilever fixed partial denture (FPD). This paper discusses briefly various factors related to cantilever fixed dental prosthesis.

Introduction

Every dentist emphasizes on the correlations that exist between biology and mechanics in treating patients with either fixed or removable partial dentures. Distribution of stress within physiologic limitations of supporting structures in both types of restorations plays a vital role resulting in a successful outcome.

The cantilever fixed partial denture is a restoration with one or more abutments at one end and unsupported at the other end[1]. A class I lever system is created if vertical and oblique forces directed to the pontic result in forces on the abutment teeth greater than the applied stress[2].

Criteria for abutment selection

The following factors by Ewing when using the cantilever principle are a good periodontal attachment (covering maximum root surface, good alveolar bone support, favourable root length, shape, and crown length, arch-to-arch relationship, favourable tooth-to-tooth relationship.

Ante's Law states that while selecting the number of abutments for a fixed restoration, "the total periodontal membrane area of the abutment teeth should equal or exceed that of the teeth to be replaced."

Varied clinical experience also becomes an important factor in treatment planning.

Anterior cantilevered fixed dental prosthesis

Cantilevered fixed dental prosthesis shows more success in anterior than posterior because the forces are less in the anterior region than posterior quadrants A cantilever fixed dental prosthesis requires at least two abutment teeth. The only documented indication for a single abutment is the replacement of a maxillary lateral incisor with the canine as an abutment[3]. Thus, the anterior cantilevered fixed dental prosthesis can be the ideal indication for cantilever fixed dental prosthesis.

Posterior cantilevers

In case of posterior region when a cantilever pontic is used to replace a missing tooth, forces applied to the pontic have an entirely different effect on the abutment teeth. The pontic acts as a lever that tends to be depressed under the forces with strong occlusal vector. It also places maximum demands on the retentive capacity of retainer. Even though the use of cantilevered restorations in these regions appears to be conservative the effect that it has on the abutment teeth is detrimental.

Cross arch cantilever fixed dental prosthesis

The cross-arch unilateral two-unit cantilever fixed dental prosthesis were analysed by Lundgren and Laurell[4] to register occlusal forces throughout light tooth-tapping,chewing, swallowing, and maximal biting.

They stated that in spite of functions the distal cantilevered fixed dental prosthesis was subjected to less stress than the contralateral posterior abutment with equal or smaller than local anterior forces.

The diminished forces on the cantilever units fixed dental prosthesis attributed to a deflection of the cantilever units and to not the intrusion of the connected abutments.

Forces and stress distribution

Forces applied to the cantilevered pontic are resisted through rotational and tilting movements by the abutment teeth rather than those along the long axes. Single cantilevered pontics with at least two abutments are recommended, although this may vary depending on the existing clinical conditions and the location of the pontic in the dental arch. The muscles of mastication exert the strongest forces in the posterior arch. Placement of cantilever pontic posteriorly requires additional abutments to withstand the forces.

Henderson et al. used a practical model and a laboratory model of a three-abutment posterior fixed dental prosthesis with strain gauges.

All the models, forces to the abutments through the cantilevered pontics were resisted by rotational and tilting movements of the abutments

More than 5 hundredths of the force applied to the cantilever pontic were absorbed by the abutment nearest the cantilever pontic, but the addition of abutment teeth lessened the

force on the distal abutment. It was all over that the abutment nearest the pontic of a cantilever style of the mounted partial denture can assume over fifty per cent of the load placed against the pontic.

However, a three-abutment cantilever FDP can reduce the "combined total resultant" forces to the distal abutment compared to a two-abutment cantilever restoration.

Patients restored with FDPs with bilateral terminal abutments, an average of 26% of the muscular capacity was activated during chewing compared with 37% in the bilateral terminal abutment group in study[5].

The variations were explained by the shortage of terminal abutments inflicting lateral bending forces that activate peripheral inhibitory feedback reactions from the TMJ mechanoreceptors.

Type of opposing dentition

Antonoff[6] declared that cantilever FPDs were a lot of often indicated once reduced stress was inherent, like a whole denture in the opposing dentition.

However, Randow et al.[7] reported no major clinical significances between technical failures of cantilevered FPDs and also the kind of opposing dentitions.

They instructed that a well-supported, stable complete denture might additionally generate high functional loading.

Role of occlusion

Studies[8,9] concludes that dentition can be rehabilitated by use of FDPs with cantilever pontic on specific, isolated abutments that are periodontally compromised. Stable FDPs were successful despite individual hypermobile abutment teeth. Prolonged stability was achieved by periodontal treatment and the development of a stable, nontraumatizing occlusion. Balancing contacts were established to prevent migration, tilting, and increasing mobility when there was a possibility of FDP mobility during mandibular movements.

The forces of mastication declines with periodontally compromised teeth in dentitions with cross-arch unilateral posterior two-unit cantilever FDPs. The quadrants with the cantilevers were never assigned as the preferred chewing side 10. If the occlusion is stable and the cantilever is free from premature contacts, the cantilever would be only subjected to large forces.

Biological features of cantilever FDPs

Axially directed force of mastication is influenced by the periodontal support with cross-arch extension fixed dental prosthesis with unilateral cantilevers[10]. The periodontal tissues has less affect on the local forces on the distal unit of the cantilever because of the deflection of the cantilever. Randow and Glantzs stressed on the importance of mechanoreceptor mechanism of periodontal membrane[11]. The vital teeth with bone support had a more efficient form of mechanoreceptor function at lower degrees of bending than nonvital teeth.

Application of cantilever restorations in implants

The guidelines for key implant positions for fixed prostheses appears with the first rule of not designing prosthetic cantilevers in the fixed prosthesis for partially edentulous patients of full-arch maxillary fixed restorations. This is because of the fact that cantilevers are significant force magnifiers to the cement or prosthesis screws, prosthesis superstructure, abutment screws, implant bone interface and the implants.[12,13]

Cantilever options in esthetic zone, when two adjacent teeth are missing anterior to canine and the intra tooth space is less than 12mm which usually occurs in the mandibular arch a cantilever may be an acceptable option. In the mandibular arch when a central incisor and a lateral incisor are missing, a larger diameter implant in the central incisor position and a cantilevered pontic to replace the lateral incisor is indicated. In case of a maxillary arch the intratooth distance will be mostly greater than 12mm and hence two implants can be inserted. In a completely edentulous mandibles, a cantilever is often the most prudent treatment option. Pontics are cantilevered from anterior implants. When this option is considered, the force factors of parafunction,crown height space, masticatory dynamics,implant location and opposing arch are closely scrutinized.[14]

Conclusion

It can be concluded from that the optimal treatment for replacing missing teeth is a fixed dental prosthesis secured at both ends. The cantilever is considered a compromised solution especially for unilateral edentulous dentitions. Abutments should have suitable periodontal support, researchers have demonstrated that extensive cross-arch fixed dental prosthesis with cantilevers can be inserted with a minimal periodontal ligament if the occlusion is stable and harmonious. The deflective capacity of the cantilever with the stimulation of the mechanoreceptors in the periodontium reduces the stress on the restoration aiding the compromised periodontal ligament.

Technical failures are more common when nonvital

teeth are abutments, because deterioration of tooth structure can be insidious. More occlusal force can also be inadvertently extended to nonvital teeth because their pain threshold is more tolerant.

With the rapid advancement of osseointegrated implants, the cantilever fixed dental prosthesis are used in sparse.

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