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ملاحظات: لا يوجد



Load bearing capacity of inlay retained cantilever bridges with different preparation designs and materials

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By

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Dedication

I wish to dedicate this work to

My great parents, whom I could have never done this without their support, encouragement and sacrifices.

Thank you for teaching me to believe in myself, in god, and in my dreams.

My dear husband , for supporting me during my thesis work,

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Introduction

Treatment options for the replacement of a single missing tooth have expanded over the last decades. The edentulous area can be replaced with either conventional metal-ceramic or all-ceramic fixed dental prostheses (FDPs), or implant-retained restorations¹. Apart from esthetic deficits, conventional FDPs have the disadvantage that 50–70% of sound hard dental tissue is removed by crown preparation², which results in loss of tooth vitality in 10% of the cases³. Therefore, these options are considered an optimal treatment decision in cases where the adjacent teeth are carious or extensively restored.

In order to enable healthy tooth structure to be preserved as much as possible, new ceramic materials, as well as advances in the field of adhesive cementation techniques were introduced. These have increased the use of all-ceramic crowns and facilitated innovative, conservative preparation designs for single tooth and FDP restorations³. In several conditions, such as the presence of pre-existing fillings, or caries and when implant therapy is not an option, inlay-retained fixed dental prostheses (IRFDP) are recommended⁴.

Here, the type of abutment preparation can be adapted to the extent of the carious tooth structure or filling, thus minimal tooth substance is lost. IRFDPs are generally fabricated using metal-ceramic, all-ceramic, and fiber-reinforced composite materials, and are considered in some cases alternatives to conventional full coverage restorations⁵.

Many studies were carried to investigate the load bearing capacities of IRPDP made from different materials, these studies has showed that minimally invasive inlay preparations restored with pressed glass-ceramics IPS e.max did not achieve the load-bearing capacity required for fixed dental prostheses in the molar

region and showed high failure rate whereas inlays made from yttrium-oxide stabilized zirconia ceramic did⁶. Several factors have been suggested to affect the survival of these IRFDPs. These include, tooth preparation design, the adhesive system and retainer design⁷. To address these problems, modified preparation designs have been developed to improve the stability of IRFDPs. These new designs have been previously described in a case study⁸, and similar forms have been described as experimentally suitable in a recent survey of artificial teeth⁷.

In contrast to 2 retainer IRFDP clinical studies in the posterior region, for the anterior region clinical trials with both, double-retainer and single-retainer all-ceramic resin-bonded fixed dental prostheses (RBFDPs) have been published^{9,10}. A clinical report on the long-term survival rate of one retainer RBFDPs replacing missing anterior teeth showed promising results with a survival rate of up to 92% after 5 years⁹. In this context the question remains if such outcome can also be achieved in the posterior region.

One laboratory study evaluated the effect of different preparation/framework designs on the failure load of zirconia cantilever IRFDPs. In this study, the inlay and wing design had an important influence on the survival of cantilever IRFDPs, as the combination of both mechanical and adhesive retention helped to withstand the highest failure loads¹¹.

This raises the question, whether modified preparation designs with an additional retainer wing to increase the adhesive bonding area would improve stress distribution leading to better outcomes and load bearing capacities especially in the posterior region. Also whether the use of new materials like PEEK would have a better influence on the load bearing capacities of inlay-retained cantilever fixed dental prostheses (IRCFDP). Therefore, the aim of this study was to evaluate the effect of different retainer designs, on the failure load of all-ceramic IRCFDP for replacement of premolars.

Review of literature

In current dental practice, the treatment philosophy is based on the least invasive approach, whereby intact tooth tissues are conserved as much as possible¹². Therefore, the interest in partial coverage retainers such as inlays and onlays have increased drastically because these restorations are able to provide a more conservative option requiring minimal tissue removal thus preserving healthy tooth structure to a maximum extent.

Replacement of missing teeth area can be accomplished with resin-bonded fixed dental prostheses (FDPs), conventional fixed dental prostheses (FDPs), implant-supported FDPs, or removable dentures². If a patient rejects an implant treatment and enough sound tooth structure is available it would be desirable to restore a missing tooth with Inlay-Retained Fixed Partial Denture instead of full coverage retained one¹³.

In recent years the desire for Inlay-Retained Fixed Partial Dentures (IRFPD) to preserve tooth structure and restrict abutment preparation has increased. Pulpitis and long-term pulpal reactions seem to be considerable risks of crown preparation. In a recent study, irreversible pulpitis and pulpal necrosis had occurred after 10 years in 15.6% of the teeth treated with single crowns and in 32.5% of teeth restored with bridge prosthesis, respectively. Approximately 63–73% of coronal tooth structure is removed when teeth are prepared for all-ceramic crowns¹⁴.

Due to these facts, Partial coverage preparations like inlays, onlays, and overlays have been recommended as retainers for short span FDPs². Important treatment planning requirements should be: a caries-free/minimal caries oral environment; good periodontal condition and orientation of the abutment teeth; sufficient clinical crown height; stable occlusal scheme and desired patient outcomes². Minimally invasive preparation designs for RBFDPs that preserve enamel with increased use of