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Pathology Question:

What are some common reasons why fixed partial dentures fail?

Report:

Common reasons of failure for fixed partial dentures (FPDs) can be contributed to biological complications and/or technical complications. Biological complications include secondary caries, loss of vitality, abutment tooth fracture, or periodontal disease. Examples of technical complications would be issues with the material, loss of retention, or marginal discoloration.

Secondary caries have been reported as one of the most likely biological reasons of FPD failure, usually occurring on the abutment level. In an analysis performed by Sailer et al. (2015), the annual rate of failure due to caries varied between 0.09% to 0.54% depending on the type of FPD. The lowest rate corresponded with reinforced glass ceramic FPDs whereas the highest rate was for metal-ceramic FPDs. Recurrent caries is related to the design of the FPD and patient hygiene. FPD contour designs should mimic normal anatomy with a distinct margin; it should minimize the opportunity for bacterial colonization and caries. Furthermore, vitality of abutment teeth was lost during the observation phase of studies despite initial vitality when the FPD was cemented (Sailer et al., 2015). Loss of abutment vitality contributes to FPD failure as endodontic treatment will become necessary to prevent pulpal disease.

Since abutment teeth are meant to withstand forces that would normally be directed to the missing teeth, they cannot be mobile, and its surrounding supporting tissue must be free from periodontal defects. A fracture in the abutment teeth or recurrent periodontal disease contributes to the incidence of failure in FPDs due to lack of sufficient support or health. If the restoration margin is placed too deep below the periodontal tissues, it will violate the biologic width resulting in inflammation and possible progression towards bone loss.

Regarding issues with the material, FPDs can experience framework fracture or ceramic chipping as technical complications. Framework fracture is the most frequent reason of failure among all-ceramic FPDs, and they have been found to fracture when placed in posterior areas where the diameter of connectors is decreased. When parafunctional habits and malocclusion are factored in, there is additional stress and impact on the FPD. It results in material fatigue and biomechanical overload. Ceramic chipping can also occur because it is difficult to obtain the proper uniform thickness for the framework and therefore, adequate support cannot be provided if it is too thin.

Material selection is vital in preventing FPD failure. In metal-porcelain FPDs, the combination of an alloy and porcelain should be compatible based on the patient's needs since each material type has its own advantages and disadvantages. Mechanical properties to pay attention to would be elasticity, yield strength, hardness, and creep. Tensile strength, ductility, and toughness are also other important characteristics to consider. While dental porcelain can resist compressive loading, it is susceptible to tensile stress which is why ceramic can fracture.

Furthermore, both all-ceramic and metal-ceramic FPDs are susceptible to marginal discoloration; it is another frequent complication contributing to failure. One explanation is

errors in the manufacturing process because it needs to be of high precision. Certain materials such as pressable glass-ceramics lend itself better to more precise technique when manufacturing the FPD framework. Some studies have also reported high rates of internal gaps or discoloration when using the CAD/CAM system to analyze the fit of the FPD framework. It suggests there is a higher possibility of misfit with a CAD/CAM reconstruction compared to using conventional metal-ceramic techniques. A deficient fit or design due to gaps can lead to loss of retention compromising FPD success. Loss of retention can also be from unsatisfactory preparation of abutment teeth. The appropriate occlusocervical crown length should be achieved, and a short crown can result in failure to retain the FPD. Overall, reasons for FPD failure can be traced back to the need for further improvements in manufacturing and design of reconstructions, particularly all-ceramic ones.

References:

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