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Pathology question: What directional forces are destructive to an RPD abutment?

Report:

A removable partial denture (RPD) is an appliance that serves to replace missing teeth. Typically, the prosthetic teeth are attached to a gingival colored base, which is connected to a metal framework that has clasps that connect to the abutment tooth or teeth (ADA, 2020). An abutment tooth is a tooth that supports a fixed partial denture or RPD and may require a crown prior to fabricating and placing the prosthesis. An RPD undergoes multiple stress types during function. The forces include dislodging, horizontal, torsional, and vertical displacement forces during occlusion and rest (Kreyer, 2015). These forces include tissue ward movement and tissue away movement. The tissue ward movement is created by masticatory forces. The tissue away movements are created by sticky foods pulling the denture occlusally, the muscles and tongue, and gravity. Intercuspation of the teeth may induce horizontal and rotational forces. For RPDs with edentulous areas posterior to the remaining teeth, torsional cantilever forces are destructive to the abutment tooth.

A cantilever is a structure that is supported on one end and extends horizontally. This is equivalent to the distal extension of an RPD. When it undergoes load forces at the unsupported end, the load is carried to the support area and applies stress there. That stress leads to a bending moment, or torsional force. In the case of an RPD, the torsional forces are supplied to the supporting abutment tooth. During occlusion, forces are best tolerated by the periodontal ligament when they are directed parallel to the long axis of the tooth, or apically (Mussen, 2020). In normal function, the PDL transmits and absorbs forces between the teeth and alveolar bone, allowing the tooth to adapt to pressure without injury. However, support from teeth and the edentulous ridge are not equal under occlusal loading.

The torsional forces created by an RPD on an abutment tooth may extend outside of what the periodontal ligament can tolerate. Such forces not only damage the periodontium through extraction forces, but also increase the amount of trauma on the natural tooth (Hussain, 2015). If the forces exist on the buccal or lingual of the tooth, they may damage the PDL and cause unwanted orthodontic movement. Rest seat design is essential in these cases, because the positive seat directs forces down the long axis of the tooth. A positive rest seat is a seat that angles toward the center of the tooth in an angle less than 90 degrees, which distributes forces apically.

During occlusion, the RPD moves towards the mucosa of the residual alveolar ridge. This creates a cantilever like torque force on the abutment tooth, which leads to rotational movement beyond the limits of the periodontal ligament. Over time, stress on the abutment tooth can lead to tooth loss and failure of the RPD. Class I levers cause extraction forces on a tooth for a distal extension RPD, and they are created if an RPD is improperly designed to have a non stress releasing clasp, such as an Akers clasp right in front of the distal extension. The issue can be mitigated by careful design of the prosthesis while taking physics and the crown to root ratio into account (Allen, 2015). Utilizing different clasp designs may also help mitigate destructive forces with the goal of converting the class I lever into a class II or III lever. Class III levers are the ideal levers that the RPD design is trying to create, which is achieved by a stress releasing clasp such as RPI, RPA, or combination clasp with wrought wire.

References:

ADA. (2020). Removable Partial Dentures. Retrieved November 10, 2020, from <https://www.mouthhealthy.org/en/az-topics/d/dentures-partial>

Allen, P., & Tada, S. (2015, June 8). The Impact of the Crown-Root Ratio on Survival of Abutment Teeth for Dentures - S. Tada, P.F. Allen, K. Ikebe, H. Zheng, A. Shintani, Y. Maeda, 2015. Retrieved November 10, 2020, from https://journals.sagepub.com/doi/abs/10.1177/0022034515589710

Hussain, K., Azzeghaibi, S., Tarakji, B., Rajan, S., Sirajuddin, S., & Prabhu, S. (2015, June 26). Iatrogenic Damage to the Periodontium Caused by Removable Prosthodontic Treatment Procedures: An Overview. Retrieved November 10, 2020, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4541304/

Kreyer, R. (2015, October). Biomechanics of Removable Partial Dentures. Retrieved November 10, 2020, from https://idt.cdeworld.com/courses/4965-biomechanics-of-removable-partial-dentures

Mussen, D. (2020, May 03). Replacement Of A Single Missing Tooth - Tooth Structure. Retrieved November 10, 2020, from https://www.mussenhealth.us/tooth-structure/replacement-of-a-single-missing-tooth.html