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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. The pontics 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 bridge 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). 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. Overtime, that torsional stress becomes destructive to the abutment tooth. During occlusion, forces are best tolerated by the periodontal ligament when they are directed parallel to the long axis of the tooth (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, 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, but also increase the amount of trauma on the natural tooth (Hussain, 2015).

In edentulous areas, bone resorption of the residual alveolar ridge will lead to first order, class I lever forces along the fulcrum line (Kreyer, 2015). 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 a rotational movement beyond the limits of the periodontal ligament. If there is better residual ridge support, the prosthesis will not move vertically and there will be less stress present on the abutment tooth. Over time, stress on the abutment tooth can lead to tooth loss and failure of the RPD. The issue can be mitigated by careful design of the prosthesis while taking physics and the crown to root ratio into account (Allen, 2015).

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