Iatrogenic Damage to Enamel During Fixed Orthodontic Treatment: What is the Evidence Telling Us?

- Enamel is the hardest material in the human body but cannot be regenerated if lost
- The outer layer of enamel has equilibrated with the oral environment to reduce impurities in the crystallites which reduce the solubility of this layer thereby making it more resistant to dental caries
- Enamel protects the underlying dentine which is more susceptible to wear, erosion and dental caries
- Enamel is strong under compression but comparatively weak under tensile forces
- The cervical enamel is thin so relatively minor damage may expose the underlying dentine
- Fixed orthodontic treatment involves numerous steps that can produce damage to the enamel surface
- How attachments are adhered and removed from the teeth influence the likelihood and amount of damage
- Damage to the tooth surface can occur during professional tooth cleaning, etching / conditioning / sandblasting, bracket removal and adhesive removal
- Professional tooth cleaning may be unnecessary depending on what chemical conditioning of the surface is planned
- Damage at professional tooth cleaning is more dependent on the choice of cup or brush rather than the choice of pumice
- Etching or conditioning will remove enamel
- This chemical preparation of the tooth surface should be limited to the area that will be bonded to
- Bracket removal can cause enamel failure resulting in tear outs
- Tear outs are more likely when removing ceramic brackets compared with metal brackets
- Ceramic brackets adhered with resin-modified glass ionomer cement had less enamel on the adhesive compared with composite resin adhesives
- Bracket removal techniques that transmit tensile forces through to the enamel increase the risk of enamel failure
- Removal of adhesive remnant can damage the enamel surface
- Tungsten carbide slow speed adhesive removal burs were found to be less damaging to the enamel surface compared with high speed tungsten carbide burs and abrasive discs
- The number of rebonds should be minimized as each bonding and debonding cycle will expose the tooth to more enamel damage
- White spot lesions are particularly susceptible to damage at adhesive removal
- Remineralisation of white spot lesions around orthodontic brackets has been shown *in vitro* to reduce the extent of enamel damage at adhesive removal