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HANDOUT

APD Mechanism of Action

- Abrasion is the process of wearing something away. In terms of tooth polishing, abrasion wears away unwanted materials such as biofilm and extrinsic stain from hard tissues.
- Over-abrasion is an excessive wearing away of tooth surfaces that is damaging to hard tissues (enamel, dentin, cementum). Over-abrasion can be intentional or unintentional.
    - Unintentional over-abrasion occurs due to many reasons such as incorrect provider technique or incorrect delivery selection.
- APD delivers a slurry of compressed air, powder particles, and water to tooth surfaces. The water expelled from the APD nozzle causes the release of kinetic energy. Kinetic energy is created when the velocity of water is increased, which decreases pressure as proven by Bernoulli's Principle. This change of pressure, in response to an increase in fluid speed, causes the release of kinetic energy. The 2 effects below produce a slurry that is less abrasive to tooth surfaces than a rotary handpiece polisher with a polishing agent.
    1. The kinetic energy produced by the water fragments the powder particles reducing their size before they contact the tooth surface.
    2. The water dampens the impact of the abrasive powder particle that strikes the tooth surface.

Rotary Handpiece Polishing

- The most commonly used polishing agents during routine preventive procedures are calcium carbonate and flour of pumice. No industry standardization for particle shape, size, hardness, and abrasiveness. Manufacturers determine their particle design for coarse, medium, fine, and super/ultra fine.
- It is difficult to calibrate provider technique during rotary handpiece polishing. Variables such as the speed used for rotary cup rotation, the pressure applied to the rotary cup, the cup angulation, contact time, and the quantity of paste used during polishing influences abrasion effects. The risk for over-abrasion increases in the following situations:
    - Higher speed of rotary cup rotation.
    - Heavier lateral pressure applied to the rotary cup.
    - Incorrect rubber cup angulation to the tooth surface.
    - Increased quantity of polishing agent applied.
    - Increased stiffness of the rubber cup, rubber point, or bristle point. The stiffness of these materials is not industry standardized and varies by manufacturer.
- The American Dental Hygiene Association endorses selective polishing to limit the removal of hard tissues.
- Cervical enamel is more prone for removal than the occlusal because occlusal enamel is thicker. Cementum in the cervical region of teeth is very thin ranging from 20-50µm in thickness. This area of a tooth has an increased risk for over-abrasion when exposed to high Mohs hardness materials.

Air Polishing Device

- Stand-alone air polishing device: Pair powder emission velocity with level of abrasion needed.
- Portable handheld air polishing device: Indicated for air polishing 1-3 teeth. Smaller powder chamber - deplete their powder faster than a larger chamber – increased risk over abrasion. Unchangeable powder emissions flow velocity – always max power. An internal control regulates the amount of powder expelled which is largely dependent on the amount of powder in the chamber.

- Standard nozzle: supragingival air polishing. If powder allowed sub-g then shown to reach down to 3mm.
- Subgingival nozzle: intended for sub-g application in pockets over 4mm. A subgingival nozzle directs its slurry into the periodontal pocket creating a vacuum-like environment through the Venturi Effect. The Venturi effect shows when a fluid is forced into a small area (periodontal pocket) the pressure will decrease which increases the velocity of fluid movement.

APD Clinical Applications

- Biofilm removal for routine preventive and therapeutic procedures. Aids in the treatment and management of periodontal and peri-implant diseases. Will not remove firmly established dental calculus but has been shown to remove immature or early forming dental calculus.
- Decontamination and debridement of orthodontic appliances.
- Surface preparation prior to orthodontic bracket placement, direct restoration placement, bonding or cementing indirect restorations (inlay, only, crown, veneer), fluoride application, whitening procedure, or sealant placement. APDs provide superior microbial reduction and depth of penetration into pits and grooves of teeth than rotary handpiece rubber cup or bristles with prophylaxis pumice paste which improves the bond strength of the dental material.
- Dentinal desensitization through occluding exposed tubules. This is dependent on the powder as some contain chemicals will occlude tubules and others do not.
- Inflammation gingival and peri-implant tissues with glycine and erythritol.
    - Glycine powder is postulated to have anti-inflammatory effects through inhibiting inflammatory cell activation and immunomodulatory effects through decreasing cytokines and toxic medicators such as free radicals. Glycine powder inhibits the synthesis of a peptidoglycan component necessary to maintain cell wall integrity of bacteria.
    - Erythritol powder is made of erythritol and added 0.3% chlorhexidine. It has been postulated in the literature to have an inhibitory effect on bacterial replication by decreasing nucleic acid synthesis and amino acids. It has been shown to slow down the extracellular matrix biosynthesis by bacteria thus disrupting the structural integrity of oral biofilm. Added chlorhexidine provides antimicrobial action other powders do not possess.

Considerations

- Severe gingival inflammation, Gingival injury
- Sodium bicarbonate: Recent literature has shown the actual amount of powder ingested by a patient during a one-time APD exposure to sodium bicarbonate is minimal and causes clinically insignificant changes to blood pH, sodium, chloride, and potassium levels throughout the body. No contraindications exist for those on sodium restricted diets.
- Dental materials: APD powders have the potential to scratch, dull, or roughen certain dental materials depending on the powder and delivery system, but have never been shown to crack, chip, remove, or crater materials when used correctly per manufacturer directions. Always follow manufacturer directions for this.
    - APD Safe for:
        - Dental ceramics and porcelain bonded alloys: APD powders have not been shown to cause surface alterations to dental ceramics such as porcelain, alumina, zirconia, and porcelain bonded alloys (porcelain fused to metal crown).
        - Orthodontic appliances: APD powders are safe and indicated for oral deposit removal around fixed orthodontic appliances.

- APD use with caution: check manufacturer guidelines.
  - Composite resins: Literature is mixed on the effects APD powders have on composite resins. Studies have found powders cause significant surface roughness, little surface roughness, and no surface roughness. Glycine and erythritol cause less surface alteration than other powders, likely owing to their chemical composition, lower particle size, and lower Mohs hardness.
  - Amalgam: powders may cause discoloration, dulling, or change to surface characteristics of amalgam restorations.
  - All-metal cast and stainless-steel alloy: The literature is mixed on the effects APD powders have on all-metal castings such as gold, palladium, platinum, and stainless-steel alloys (crowns commonly used in pediatric patients) over time. Some studies show discoloration, matte finish, or erosion while others do not.
  - Removable appliances (partial, denture): Erythritol and glycine can be safely used on removable appliances while powders with a higher particle size may be contraindicated.
- APD Contraindicated
  - Adhesives: Air polishing with sodium bicarbonate or calcium carbonate prior to operative dentistry has been shown in some studies to negatively affect the bond strength of a dental adhesive, while the use of glycine did not. The explanation of this anomaly is postulated to be the different effects glycine has on the dentin than sodium bicarbonate and calcium carbonate. Glycine does not occlude dentin tubules and can remove the smear layer on dentin unlike sodium bicarbonate and calcium carbonate powders.
  - Glass ionomer cement and sealant: It would be best practice to avoid direct use of an APD powder on a glass ionomer cement and sealant due to the risk for substance loss and surface alteration. Studies vary in their reports with some showing less surface alteration with glycine and erythritol than other powders. Refer to the manufacturer DFU/IFU.
  - Luting cements: sodium bicarbonate, aluminum trihydroxide, calcium sodium phosphosilicate, and calcium carbonate may remove luting cements and their use should be avoided on the direct margins of restorations.

Technique

Dentsply Sirona

- 2-4mm nozzle distance from tooth. Expose each tooth to slurry 1-2 seconds and rinse with water.
- Occlusal nozzle angulation 90-degrees.
- Anterior nozzle angulation 60-degrees.
- Posterior nozzle angulation 80-degrees angled distally.

Woodpecker/EMS/Acteon

- 3-5mm nozzle distance from tooth. Exposure each tooth to slurry 5-10 seconds.
- Supragingival: angle away from gums.
- Subgingival: angle toward gums.
- Occlusal nozzle angulation 60-degrees.
- Anterior/Poster nozzle angulation 30-to-60 degrees.

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