Abrasion and polishing
Lect 19&20

Ashur University College

Dr. Mohammed Moudhaffer

Before any restoration or appliance is placed permanently in the mouth it should be highly polished. In spite of all the care taken during processing, many restorations and prostheses usually require further trimming, smoothing and finally polishing.

A rough or unpolished surface may:

- **Be uncomfortable to the patient.**
- **Cause food and other debris cling to it and makes it unhygienic.**
- **Lead to tarnish and corrosion.**

ABRASION

It occurs when a hard, rough surface slides along a softer surface and cuts a series of grooves.

DEFINED AS

The wearing away of a substance or structure through a mechanical process, such as grinding, rubbing or scraping .

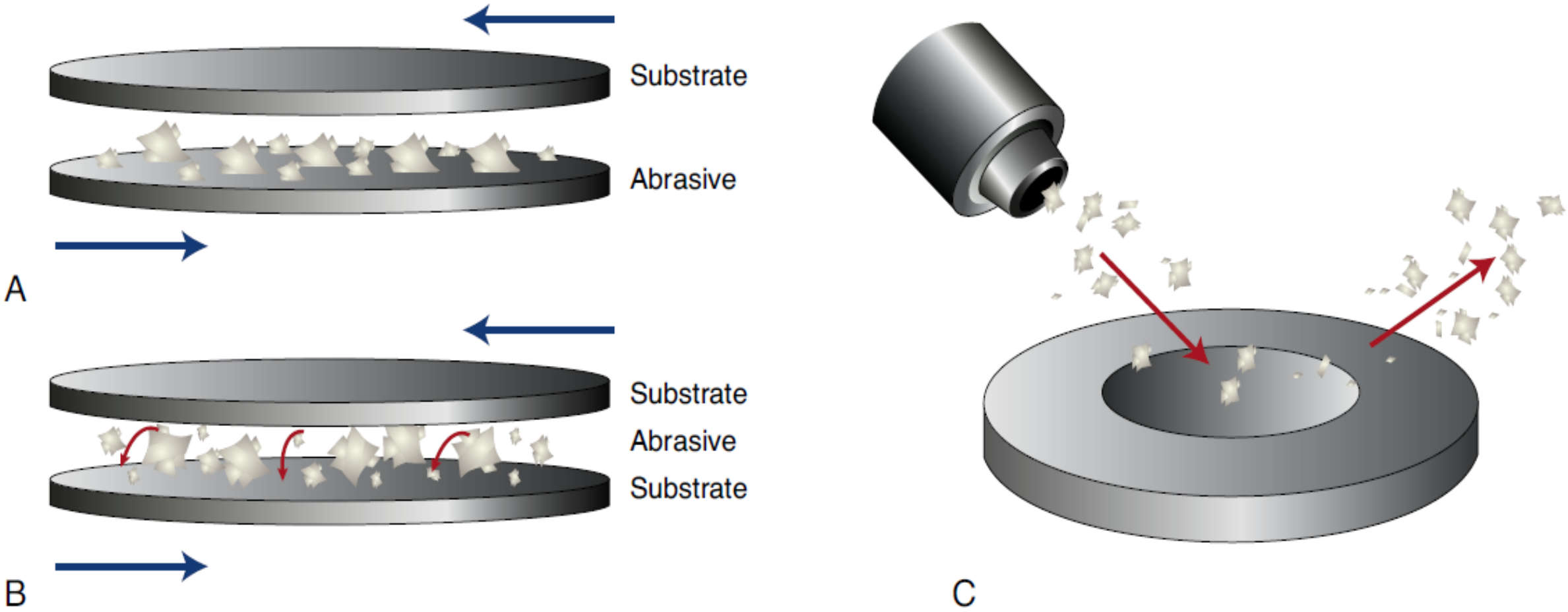
TYPES OF ABRASION

Abrasion may be:

A two body process, e.g., action of a diamond bur on enamel.(abrasive are bonded to the instrument).

A three body process, e.g., pumice applied with a bristle brush. (abrasive particles stay free).

Erosion: **A process of material removal achieved by air-pressure– propelled abrasives (air-particle abrasion).**



• **Figure 16-2** Illustrations of modes of wear involving abrasive particles. **A,** Two-body abrasion occurs when abrasive particles are tightly bonded to the abrasive instrument that is removing material from the substrate surface. **B,** Three-body abrasion occurs when abrasive particles are free to translate and rotate between two surfaces. **C,** Hard-particle erosion (also called *air-particle abrasion*) is produced when abrasive particles are propelled against a substrate by air pressure.

Two body abrasion



Three body abrasion



Abrasive : Is a hard substance used for grinding, finishing or polishing of a less hard surface, or the material that causes wear is called abrasive.

Substrate: The material being abraded is called a substrate.

Rate of abrasion

The rate of abrasion of a given material by a given abrasive is determined primarily by the followings:

1. Hardness

hardness of an abrasive is directly proportional to the rate of its abrasion .The harder the abrasive than the substrate the more abrasion will be produced.

2. Particle size: Larger, coarse abrasive particles will abrade a surface more readily than smaller particles, but they tend to leave more coarser scratches in the substrate.

3. Particle shape

Sharp, irregular shaped particles will abrade a surface more rapidly than will rounded particles having dull cutting angles. However the former will produce deeper scratches than later.

4. Speed and pressure

Both speed and pressure are directly proportional to the rate of abrasion. At higher speed greater friction is produced, which tends to produce higher temperatures. Similarly, greater pressure causes higher temperatures & possibly patient discomfort.

Lubrication

Lubricants are used during abrasion for two purposes:

1. **to reduce heat buildup.**
2. **to wash away debris to prevent clogging.**

But too much lubrication can reduce the abrasion rate by preventing the abrasive from coming in contact with the substrate.

Abrasive instrument design:

1. Abrasive grits: these are derived from materials that have crushed and filtered through a series of mesh screens. The types of abrasive grits are based on particle size which are coarse, medium and fine.



2. **Bonded abrasives: these are bonded or incorporated into a grinding tool. The bonded abrasive tend to disintegrate rapidly since the particles detach with time.**

3. Non –bonded abrasives: these involve adding a paste or a water soluble medium to a non abrasive instrument that is made from rubber or cloth brushes.

CLASSIFICATION OF ABRASIVES

Abrasives used in dentistry can be classified into the following three types:

1. Finishing abrasives: These are generally hard, coarse and used primarily to produce the desired contours of a restoration or tooth preparation.

2. Polishing abrasives: Have finer particle sizes and are less hard than the finishing abrasives, they are used to smooth surfaces roughened by finishing abrasives

3. Cleansing abrasives

Cleansing abrasives are soft materials with small particle sizes and are intended to remove soft deposits that adhere to enamel or a restorative material.

Types of abrasives: Many types of natural and synthetic abrasives are available. Generally, synthetic abrasives are preferred because of their more predictable physical properties.

1. Arkansas stone

is a semi translucent, light gray rock mined in Arkansas. It is dense, hard & contains uniformly textured microcrystalline quartz. It is used for fine grinding of tooth enamel and metal alloys.

2. Chalk: A white abrasive composed of calcium carbonate. Chalk is used as a mild abrasive paste to polish tooth enamel, amalgam, and plastic materials.

3. Corundum: This is a white mineral form of aluminum oxide. Corundum is most commonly used in an instrument known as a white stone. Corundum has largely been replaced by synthetic alpha aluminum oxide in dental applications.

4. Diamond: A transparent, colorless mineral composed of carbon. It is the hardest known substance and is called a super abrasive because of its ability to abrade any other known substance.

Synthetic diamond abrasives : are used far more commonly than natural diamond due to its consistent shape ,size and low cost. Diamonds are mostly used on tooth structure, ceramics and resin-based composite materials.

5. **Emery: This abrasive is a grayish-black corundum prepared in a fine-grain form. Emery may be used for finishing metal alloys or acrylic resin materials.**

6. **Garnet: Consists of a group of different minerals that have the same physical properties & crystalline forms. The type of garnet used in dentistry is usually dark red. It is used in grinding metal alloys and acrylic resin materials.**

7. **Pumice: is a light gray volcanic rock derivative, used in polishing tooth enamel, gold foil, dental amalgam and acrylic resins.**

8. **Quartz: This is the most commonly used form of silica and is a very hard, colorless, and transparent mineral, used primarily for finishing metal alloys and grinding dental enamel.**

9. Sand

Is a mixture of mineral particles, predominantly composed of silica. The particles represent a mixture of colors, making it distinct in appearance. They are coated onto paper disks for grinding of metal alloys & acrylic resin materials.

10. Tripoli

Is derived from a light-weight, friable siliceous sedimentary rock. Tripoli can be white, gray, pink, red or yellow. The gray and red types are mostly used in dentistry. It is used for polishing metal alloys & some acrylic resin materials.

11. Silicon carbide

It was the first of the synthetic abrasives to be produced. It is available in green & blue-black types, having equivalent physical properties. Silicon carbide is extremely hard & brittle & results in highly efficient cutting of materials, including metal alloys, ceramics & acrylic resins.

12. Aluminum oxide

fused aluminum oxide was the second synthetic abrasive to be developed. Aluminum oxide (alumina) is much harder than corundum (natural alumina). It is popular for adjusting dental enamel & for finishing metal alloys, resin-based composites & ceramic materials.

13. Rouge: Iron oxide is the fine red abrasive component of rouge. Like tripoli, rouge is blended with various soft binders into a cake form. Rouge is used to polish high-noble-metal alloys such as yellow gold alloys.

14. Zirconium silicate

The mineral zircon is ground to various particle sizes and used as a polishing agent. It is used in dental prophylactic pastes and in abrasive impregnated polishing strips and discs.

15. Zinc oxide

Zinc oxide in alcohol can be used for polishing amalgam restorations.

POLISHING

It is the production of a smooth mirror like surface without much loss of any external form. If the particle size of an abrasive is reduced sufficiently, the scratches become extremely fine and may disappear entirely. The surface then acquires a smooth shiny layer known as a polish.

Difference between abrasion and polishing

The difference between an abrasive agent and a polishing agent is difficult to define. The terms are generally interchangeable.

- **Particle size a given agent having a large particle size acts as an abrasive, Producing scratches. The same abrasive with a smaller particle size is a Polishing agent.**
- **Material removed very little of the surface is removed during polishing— Not more than 0.005 mm (0.002 inch).**
- **Speed the optimum speed for polishing is higher than that for abrading.**

Nonabrasive polishing

Polishing is usually achieved by an abrasive process. However a smooth shiny Surface can also be achieved through nonabrasive means. These include:

1. Application of a glaze layer like glazing of composites and ceramics.
2. Electrolytic polishing.
3. Burnishing.

Methods of abrasion

Abrasion may be carried out

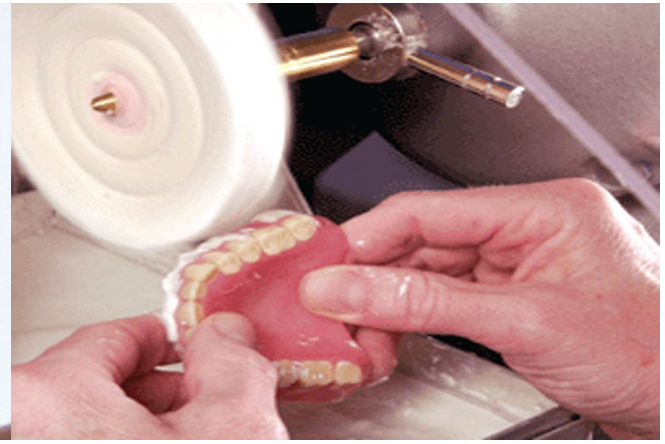
1. Manually: Proximal stripping of enamel using abrasive strips.

2. Rotary instruments: Burs, wheels, cups, discs, cones, etc.

3. Blasting: the object is blasted with a steady stream of abrasive, sandblasting to remove Investment of castings.







Denture cleansers

Dentures collect deposits in the same manner as natural teeth during their use. These can be removed by two ways:

- **Professional—repolishing in the laboratory or clinic.**
- **Soaking or brushing the dentures daily at home.**

BRUSHING

The dentures may be brushed using a soft bristle brush and gentle abrasive or cream. Hard abrasives and stiff bristles should be avoided because they may produce scratches on the denture surface.





SOAKING

Chemical cleaners are an alternative to brushing especially among very old or handicapped persons.

- **Alkaline perborates**
- **Alkaline peroxides**
- **Alkaline hypochlorite**
- **Dilute acids**

The dentures are soaked in these chemical solutions for a prescribed period of time. Their main requirements are that they should be nontoxic, non-irritant and should not attack the materials used in denture construction.

Thank you