Note: study the slides with this sheet.

We will be talking about glass ionomer and resins in this lecture. But first we are going to go through the slides of the last lecture.

Recall;

* All zinc oxides undergo an acid base reaction.

Acid + Base = Salt + Water

* Zinc oxide cements exist mainly in the powder-liquid form, where an unreacted powder core is produced, surrounded by matrix. In addition to the main components of the zinc oxide cements, additives such accelerators and pigmentations are added to enhance specific features.
* The setting time for zinc oxide eugenol can be accelerated by adding zinc acetate and zinc stearate (otherwise would take 24 hours). Note: Zinc stearate is also put on CaOH to accelerate its setting time.
* Olive oil is added to eugenal (being the main ingredient) as a plasticizer.
* Zinc oxide eugenol is affected by the size of particles; the smaller the less the setting time.
* Pressing a damp piece of cotton against the tooth as an accelerator to zinc oxide eugonol.
* When working with temporary fillings, dentists add glycerine to make sure that the filling does not get permanently adhered. A major drawback of using glycerine is that it retards the setting time of the desired cement. Therefore, it’s barely used nowadays. Since it’s a temporary filling, the conditions found in the oral cavity (saliva, heat) are capable of allowing adherence without adding any facilitators.
* The higher the powder: liquid ratio the less the setting time.
* Zinc oxide eugenol is the one of the best sedatives and can be used directly on exposed pulp (in deep cavities) to seal dentinal tubules and reduce the pain.
* Modified (quarts of alumina are added) zinc oxide eugenol has less solubility, and therefore, higher strength.
* Allergic people can use zinc oxide eugenol-free to prevent uncontrolled polymerization of composite fillings.
* Zinc phosphate, in comparison to the other zinc oxide cements, is the strongest and least soluble. That’s why it has a wider range of uses, including:

\*Used as a base under amalgam fillings

\*Temporary restoration

\*Luting for crown bridges, orthodontic bands and brackets.

- The size of the powder crystals determine the thickness of the film and hence, its function. Type 1 particles’ size; standard film thickness (25 µm) is used when we’re inserting a crown over a tooth. Whereas type 2, a thicker film (around 40 µm), is preferably used as a base.

- Make sure that the consistency of the cement is optimum, adding too much liquid would make it more soluble, thus, increasing the setting time.

* Remember that zinc polycarboxylate can be used in deep cavities in contrast to zinc phosphate, since its molecules are large and less mobile.

Glass ionomers

Glass ionomers are composed of calcium-fluoroaluminasilicate glass. The main ingredients (calcium fluoride, aluminum and silica) are mixed with water to form calcium-fluoroaluminasilicate glass.

The main ingredients are mixed together at a very high temperature and then cooled down to the freezing point in a sudden pattern(shock cold). The sudden cooling makes the mixture brittle; it’s broken down and grinded to form powder.

The particle size determines the function of the powder, if it’s large; it’s used as a base (thicker and more viscous), while small particles are used as luting agents.

When it comes to aesthetics, refractive index plays a major role in determiningthe tooth’s appearance. As light might be reflected, refracted or transmitted; these processes reflect the final appearance.

When you add restorative materials to the teeth, you’re changing its refractive index since the compositions of the materials are not identical. Hence, we’re acquiring different shades and colors. Pigmentations found in the restorative materials also play a role in determining the final color.

Pigmentations are found in glass ionomers, and this might cause a change in the color of the teeth.

We use several poly acrylic acids in glass ionomers, the poly acids are co-polymers.

Co-polymers: the cross linking of several polymers.

In the previously discussed cements, we used to have a single primary acid. Whereas in glass ionomers, we’re using more than one primary acid. For example: acrylic acid among with tartaric acid.

The liquids that are used to form zinc phosphate and glass ionomers can evaporate rapidly, therefore; their containers must be sealed whenever they’re not being used. Evaporation of the liquid affects the solubility and viscosity of the cement.

 -Solubility decreases since there’s less water.

 -Viscosity increases since loss of water causes an increase in the concentration of the acid.

Viscosity of the cement depends on the molecular weight and concentration of the poly acrylic acid.

Advantages of using tartaric acid:

* Controls the pH (not to be high), since glass ionomers are slightly irritating.
* Improves handling characteristics, including shortening setting time. (the working time stays the same)

With the presence of tartaric acid, if the powder to liquid ratio is optimum, the initial setting time would be approximately 4 minutes.

Glass ionomers can form chemical adhesion with both enamel and dentine, this bond is stronger than that of zinc polycarboxylate. For this bond to be strong enough for adhesion, water must be present.

When glass ionomer is placed, we should tint it with varnish/Vaseline to prevent the adhesion of water molecules before the setting time ends. As this would increase the solubility of the cement, hence; causing the cement to leach.

-We conclude that when we apply glass ionomers, we should prevent the adhesion of water before the setting time ends to minimize leaching. Afterwards, optimum amount of water is needed for the adhesion of glass ionomers to both enamel and dentine.

Generally, increasing the amount of liquid would increase both solubility and the setting time; this decreases the strength of the cement.

-Anhydrous cements involve reactions between the powder and water, rather than co-polymer acids.

The use of capsules is one of the easiest ways to produce cement, since the concern towards the powder to liquid ratio and working time, would be eliminated. However, this technique doesn’t completely replace the standard mixing technique, since it’s very expensive.

A second drawback of using capsules; is that it has a restricted size. In addition to that, capsules do not have a variety of shades, in contrast to the mixing technique.

-Previously mentioned, the two essential metals found in glass ionomers are calcium and aluminum. Upon reacting with the poly acrylic acids, calcium has a higher rate of activity than that of aluminum.

Glass ionomers’ compressive strength is greater than that of all zinc oxide cements.

The opposite goes for the solubility(less).

Remember that complete setting occurs after 24 hours.

A special characteristic of glass ionomers is that they are unaffected by the acids released from the bacteria, instead, they are affected by water and saliva. Hence used as an anti-bacterial. The continuous exposure to water and saliva helps in the release of fluoride ions from the cement. Hence; enhancing mineralization. This is a unique property of glass ionomer.

The chemical adhesion between glass ionomers and both the enamel and dentine involves the reaction between the carboxyl group of the acid & the calcium ions found in the enamel/dentine.

The aesthetics of glass ionomers are poor, as they lack translucency. That’s why they’re rarely used on anterior teeth.

Degree of pulp irritation:

 Zinc phosphate > Glass ionomer > Zinc oxide eugenol

Overview:

-The powder to liquid ratio is about 3:1

-Easy to mix

-Used in brackets-orthodontics

-Used in cementation

-It’s the best luting agent to be used in porcelain fused metal crowns, since it forms strong adhesive bonds with both the tooth and the metal.

-Sensitive to moisture

-Has slow initial setting time, approximately 4 minutes.

Resin: Silane-treated boro-silicate glass in a resin matrix

Resin has been lately added to glass ionomers to improve their properties.

Resin adds methacrylate to glass ionomers, which would make it stronger. It also enhances the aesthetic properties. But at the same time, it increases water absorption; which would cause hydroscopic expansion. The newly formed mixture is mainly used for children.

Resins are considered as strong materials which are the main source of composite filling nowadays. Once they’ve passed their setting time, they become completely insoluble.

They form strong bonds with the teeth, and they have a variety of functions upon fusion with metals or ceramics.

On the other hand, they’re expensive. They require multiple steps before the finishing process. In addition to that, they are extremely sensitive to contamination, and show a minor release of fluoride.

