

Introduction to Dentistry

lecture 4: Materials used in Dentistry

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Dental materials

- It is the study of **composition** and **properties** of materials used in dentistry and the way they interact with the oral environment. → hard to cope with
- The oral cavity is considered to be the **harshest** environment for a material in the body (temperature, ph, saliva, plaque, forces...). → this properties make the oral cavity very challenging to dental materials
- Every dentist (and dental assistants) should have basic knowledge of the materials used in Dentistry
- The practice of clinical dentistry depends not only on a complete understanding of the various clinical techniques but also on an appreciation of the basic biological, chemical, and physical characteristics of the dental materials in calinical applications. → because the dentist are dealing with it daily

History of dental materials

- Humans have been making and using dental appliances and dental implants for thousands of years



gold wire

Restoration of the dentition with the patient's teeth using gold wire ancient egypt around 2500 bc



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Denture

طقم الأسنان



Characteristics of dental materials

• It should be:

1. **Biocompatible** (non-toxic, non-irritating, non-allergic) لا ازعاج للمريض
2. **Mechanically stable and durable** (strong, resistant to fracture) قوي مقاوم للكسر
3. **Resistant to corrosion** (does not deteriorate overtime) مقاوم للتآكل
4. **Dimensionally stable** (little or no change to temperature and solvents)
5. **Aesthetic** (looks like normal oral tissue) جمالية
6. **Minimal conduction** (insulates against thermal/ electrical change) عازلة
7. **Easy to manipulate** سهولة المعالجة

color
natural shape

يجب أن تكون استحداثها سهل ومعالجتها سهلة لطبيب الأسنان

Classification of Dental materials

- Dental materials can be classified as:

وقائية

1. Preventive dental materials

2. Restorative dental materials

- Direct
- Indirect

3. Auxiliary dental materials

معدات مساندة

يمكن ملاحظة أن Restorative و Preventive تتداخلان في التصنيف و لا يمكن فصلهما بسهولة

The classification of dental materials is not very straight forward!

As auxiliary

Overlap

Preventive dental materials

- Aim: to prevent or inhibit the progression of tooth decay

منع / تثبيط عملية
تسوس الأسنان

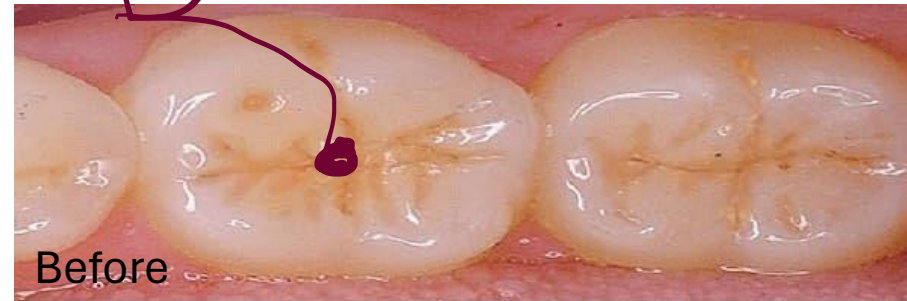
1. Pit and fissure sealants
2. Fluoride treatment:
3. Mouthwashes and cavity varnishes

Pit and fissure sealants

Posterior teeth تنظيف
Anterior teeth لا يحتاج
كحوضيات لسانها

- Pits and fissures of the occlusal surfaces of the posterior teeth are more prone to caries development than the smooth surfaces due to their morphological complexity.
- The use of pit and fissure sealants provides a physical barrier that inhibits microorganisms and food particles accumulation, preventing caries initiation, and arresting caries progression .

Pit and fissure sealants



بواسطة طبيب الأسنان
بواسطة العناية

high conc of
fluoride

Fluoride treatment

- Professionally applied fluoride therapy to prevent and arrest caries in children and adults.

التسوس

- Early childhood caries remains highly prevalent in many countries.
- Routine tooth brushing is inadequate in cleaning
- The mechanism of action of fluoride is the inhibition of demineralization and enhancement of remineralization
- Sodium fluoride (NaF) 5% varnish is a professional topical fluoride

Adding minerals



removing of minerals from
tooth structure

Restorative dental materials

→ to restore functions
of teeth

Materials used in Restorative Dentistry

- Restorative dental materials are the foundation for the replacement of tooth structure.

حشوات القضة
حشوات تجميلية

حشوات زجاجية

الترميمات: التيجان/الجسور
بوريلان

- Amalgam alloys, resin composites, glass ionomers, ceramics, cements, primers, bonding agents, noble and base metals,**

عزوز الحشوات
مكث الصمغ
تخفيف الحساسية في
التجاويف

مع الحشوات
التجميلية

Like golden tooth

تثبيت
الترميمات

التجاويف • Can be classified to:

- Direct restorations** are generally placed directly onto tooth structure and do not require laboratory preparation.
- Indirect:** formed indirectly over a cast or moth model in the lab by a technician

Amalgam

نواجهه بسهولة في تركيبها وازالتها
if placed correctly it is good choice

- Dental amalgam is a restorative material that has been used in dentistry for many years. *سبب ذلك*
- Mercury alloys mixed with other metals
- The main ingredients of amalgam alloy are silver (Ag), tin (Sn), copper (Cu) and **mercury (Hg)**. Small amounts of zinc (Zn) and palladium. *mixed by special device*
- Easy to handle, durable and cheap material

Used in posterior teeth

صالح للاستهلاك

- Its use has become questionable!!!!!!!

because of mercury presence



در این

Review | [Open access](#) | [Published: 13 January 2011](#)

Is dental amalgam safe for humans? Mercury : the scientific committee of the European

Review > Neurotoxicology
Epub 2020 Oct 14.
doi: 10.1016/j.neuro.2020.09.034.

81:382-386. doi: 10.1016/j.neuro.2020.09.034.

[Toxicol Int.](#) 2012 May-Aug; 19(2): 81-88.
doi: [10.4103/0971-6580.97191](#)

The Dental Amalgam

Review > Neurotoxicology
Epub 2020 Oct 14.

Mercury in dental amalgam: a risk analysis

of dental amalgam and alternative dental on materials for patients and users

ity
col. 2016 Aug:79:108-109. doi: 10.1016/j.yrtph.2015.12.015. Epub 2016 Jan 18.

Amalgam: a risk analysis

→ Aesthetics

Resin composites

طبقات

must be hard

A resin composite material is a material made from two or more substances

Aesthetics restorative material for anterior teeth

small amount

Consist of an **organic resin**, reinforcing filler and a **coupling agent**.

كلما كانت الالوان
خفيفه يكون هناك كبحه اكبر

Are usually used in conjunction with acid etching , primers and bonding agents. Added as increments (layers)



Acid etching



Bonding



Light cure



Composite filling



Light cure

ليس ينز

protection of tooth structure for children

Glass ionomer

سيرة واحدة في
العيادة



- Was introduced in 1972. it sets by an acid-base reaction between polymers of polyacrylic acid and fluoro-aluminosilicate bases.

- **Advantages:** fluoride release and its unique ability to bond chemically to tooth structure, can be added in bulk.

by such reaction

- **Resin-modified Glass-ionomer:** a glass ionomer with resin composite properties. It contains a resin (like a resin composite) that allows it to be set with a curing light (this is opposite to a **compomer** which is a resin composite with glass ionomer properties)

fracture ^{uses} → dental
Ceramics → prostheses
↳ as glass

- **Definition** : Materials that are part of systems designed with the purpose of producing dental prostheses that in turn are used to **replace missing or damaged dental structures (crowns and bridges)**
- Ceramics can simulate the visual character of the tooth substance successfully and are biocompatible materials.
- Porcelain-fused-to-metal (PFM) restoration
- All-ceramic crowns (aesthetics)



موقتة Temporary (provisional) restorative materials

يصطي راحة ليجاراته لاله هتان

- Temporary dental cement such as **zinc oxide eugenol cement**, temporary crown and bridge polymers.

احده مكوناته
القرنفل

- The traditional odor of dental clinics in the past is due to the use of eugenol or oil of cloves and eugenol containing dental materials such as Zinc oxide eugenol cement.

- **Intermediate restorative materials IRM**

حماية لصل طبيب الأسنان



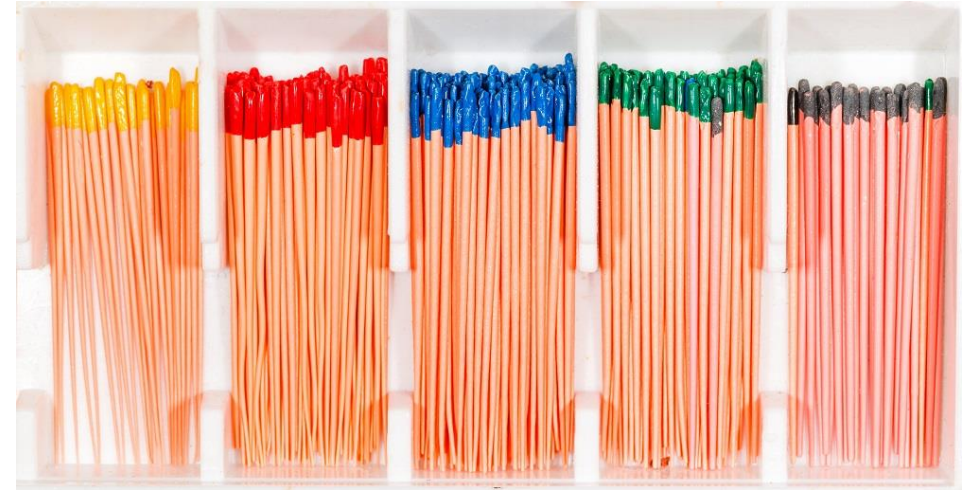
Endodontic Materials Used To Fill Root Canals

لے کے مہالوچے
الغصب

• **Gutta-Percha:** Materials used to “obturate” canals after endodontic treatment

• **Sealers:** binding agents used to adapt the rigid gutta percha to canal walls and fill up the voids

نقطہ الراجحہ



Auxiliary dental materials

لعمل الاستعاضات
السنه

- Materials used in the process of fabricating dental prosthesis.
These include:

1. Impression materials اخذ الطيفات السنه
2. Dental waxes bio compatible
3. Gypsum casts بعد الـ Impression
صب الجبين للأخذ قالب مجسم
المناه التبريد
4. Finishing and polishing abrasives
5. Acrylic resins

الجزء الذي
منه يتبع
الانذار

negative record Impression materials

طبقات

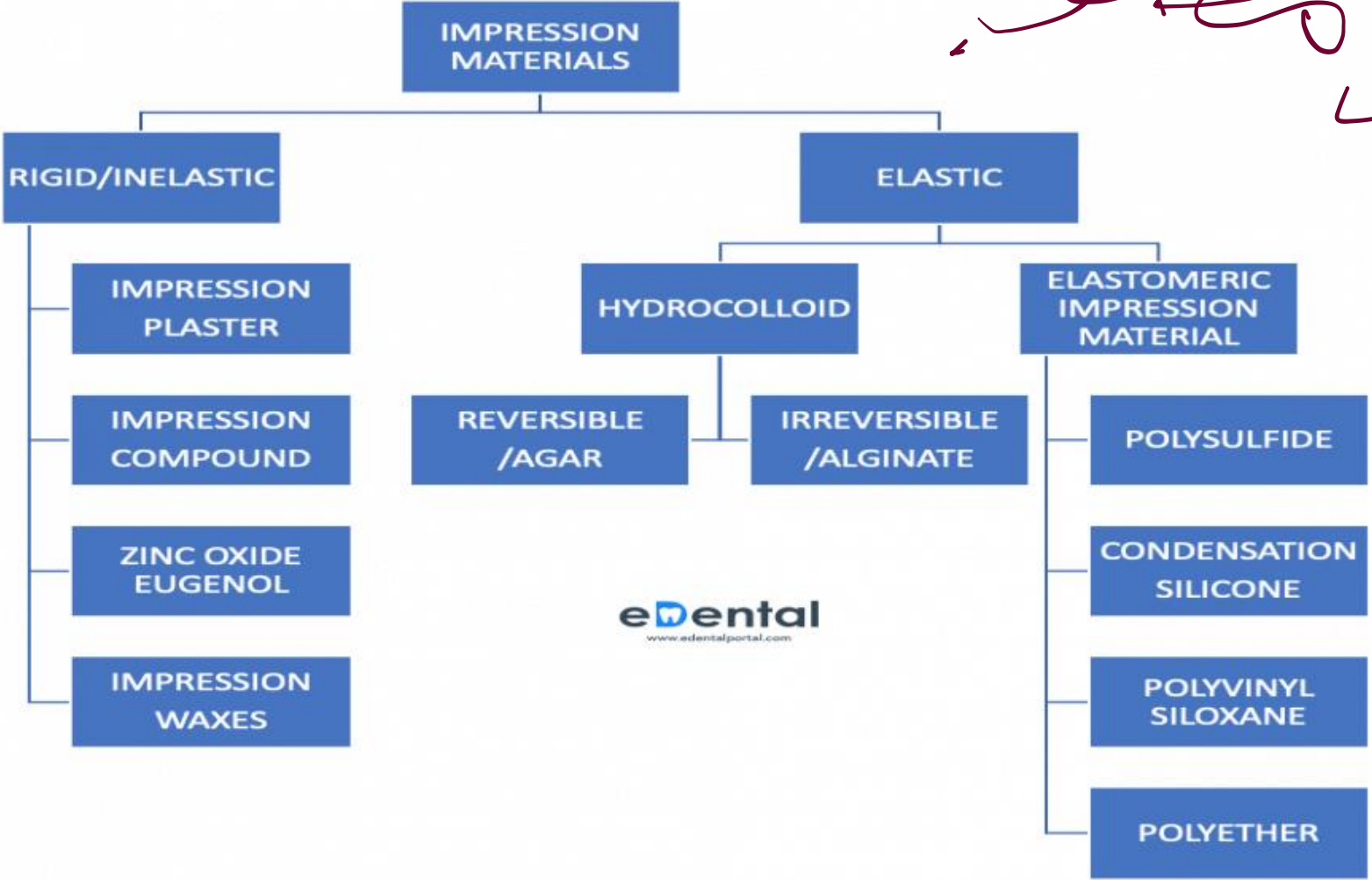
- **Impressions** are used in the dental clinics to produce accurate negative reproductions of the patients' teeth, surrounding tissues and dental arches.
- **Casts** (positive reproductions) are created from dental impressions and are used to fabricate various dental prostheses.
- **Impression trays** are used to hold the impression material, allowing the operator to place it into the patients' mouth.

قابل

احجام مختلفه
حسب عمر
المرضى



اس کے مطابق



Dental waxes

bio compatible
مناسب للاستخدام في
oral cavity

- Waxes have a variety of uses within dentistry and are manufactured from various materials, including plants, minerals, animals and synthetic waxes.
- They are thermoplastic materials that present as solids at room temperature; they can be softened with heat and hardened with cooling.



Gypsum casts

positive record

- Gypsum (calcium sulphate dihydrate) is a naturally occurring mineral used in dentistry to fabricate models

- Many dental appliances and restorations are constructed **extra-orally** using models, dies (one tooth) and casts (replicas of the patients tooth/teeth and surrounding tissues).



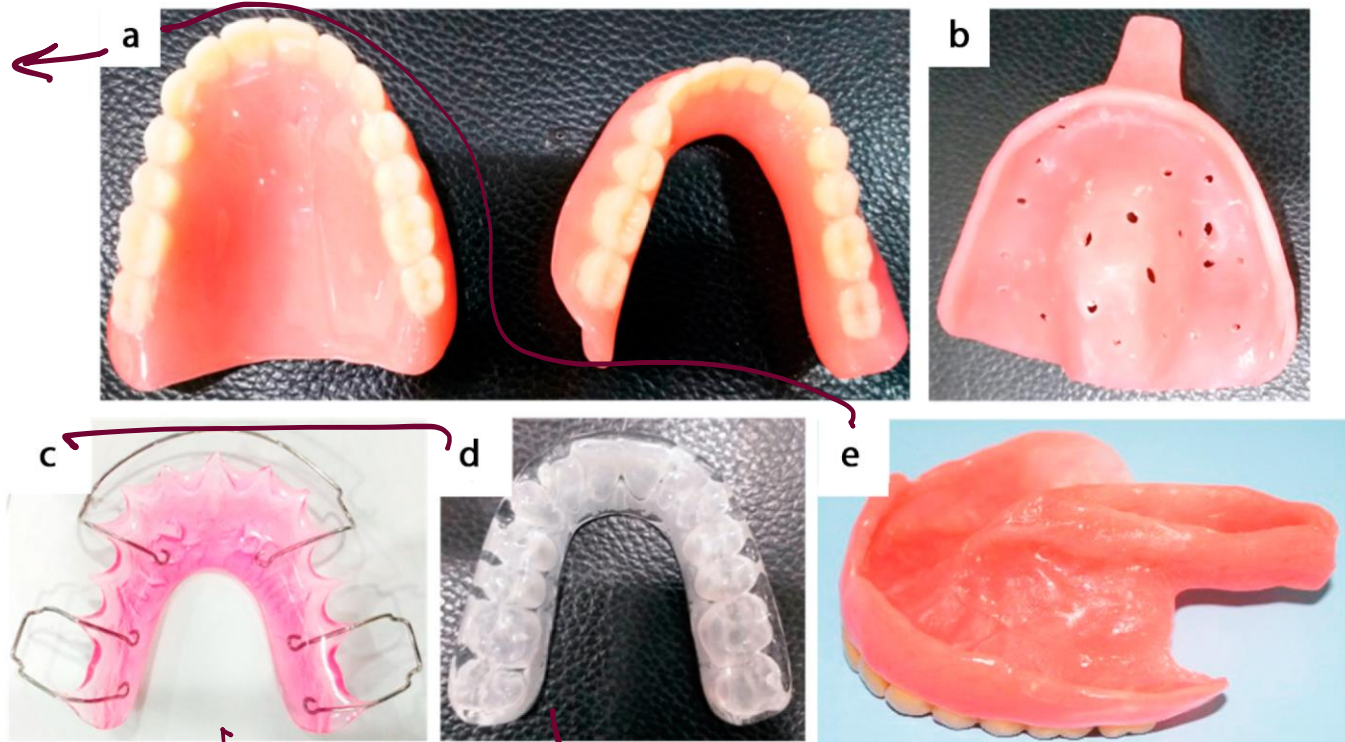
Acrylic resins

biocompatible

Bio compatible

Applications of Denture Base Materials

complete denture



partly

high costs

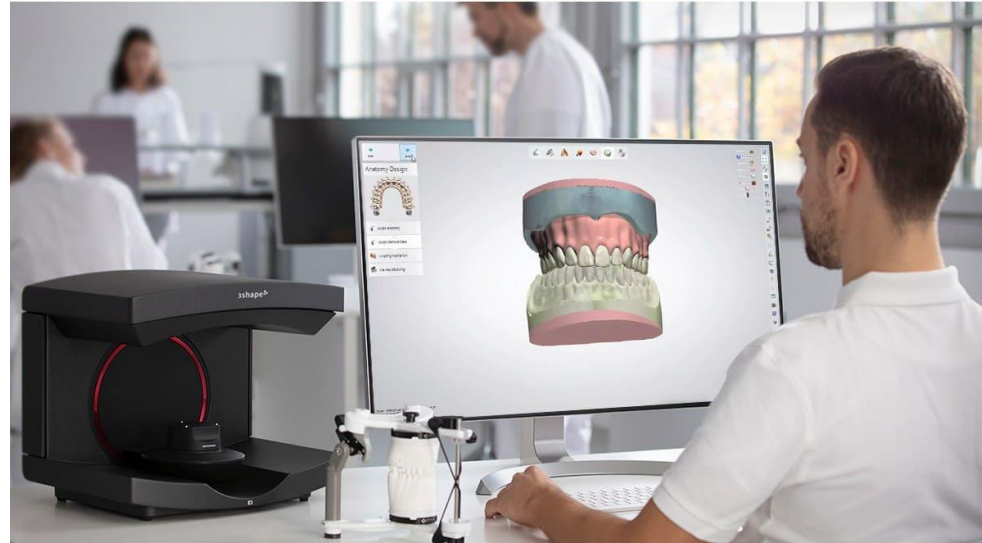
CAD/CAM

not dental material

rapidly

- Computer-aided design/computer-aided manufacturing (CAD/CAM) techniques
- Due to CAD/CAM technology, patients occasionally get restorations on the same day

اتخاذ الطبقات
بواسطة الكمبيوتر



References

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