

الجامعة السورية الخاصة SPU

كلية طب الأسنان - قسم التعويضات

مقرر مواد سنوية 1

Dental Material-1

المحاضرة الأولى

Overview of Dental Materials

أ.د. اليان أبوسمرة

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SPU

الجامعة السورية الخاصة
SYRIAN PRIVATE UNIVERSITY

Science Of Dental Material

Prof.Dr-Elian Abu samra

SPU



INTRODUCTION

DEFINITION

Science of dental materials is a **basic science** which deals with **physical, mechanical** and **biological** properties of dental materials. The study of Science of dental materials gives the operator a basic knowledge about the materials. This help to **choose** and allow to **effectively** manipulate it

Is defined as.....

The Study of composition and properties of dental materials and the manner in which they interact with the environment they are placed

Why are we studying this field?

Why are we studying this field?

- 1- for the **knowledge** to make **optimal selection** of materials
- 2- To **understand the behavior** of the materials, use ,handling, manipulation
- 3-Safety considerations** of the materials
- 4- **patient education** regarding dental restoratives
- 5-Recognition of materials** – proper care of prosth/restorations
- 6-Understand the professional literature**

the Dental Specialties

- Conservative Dentistry and Endodontic ■
- Periodontics ■
- Prosthodontics ■
- Public health Dentistry ■
- Oral Medicine and Radiology ■
- Oral and Maxillofacial Surgery ■
- Orthodontics and Dentofacial Orthopedics ■
- Oral and Maxillofacial Pathology ■
- Pedodontics and Preventive Dentistry ■

Oral Environment

It is very important to know the variables that occur in oral cavity to understanding the oral environment :

1-Temperature variations

2- PH Variations.

3-Variations in Masticatory forces

Temperature variations

Normal temperature of oral cavity (vital sine)
36-37 C.

On intake of a cold , hot food , or drink

The temperature range increases (**0 to 75 C**)

pH Variations

PH of saliva is neutral (7.0)

On intake of acidic fruit ,juices or alkaline medicament; PH may vary from **2.0 to 11.0**

Variations in Masticatory forces

- ▣ In the oral environment, restorations are subjected to heavy masticatory forces. These forces act on teeth and/ or material producing different reactions that lead to deformation, which can ultimately compromise their durability over time.
- ▣ It is important to introduce some concepts that are extremely relevant to understand the performance presented by such materials under specific test conditions.

Variations in Masticatory Forces

Muscles of Mastication apply forces to the dentition.

Masticatory forces vary from tooth to tooth.

Average force applied by the tooth **increases from anterior to posteriors.**

Tooth	Average (force (N
Second molar	80800
First molar	390
Bicuspids	288
Cuspids	208
Incisors	155

History of Dental Materials

Dating as early as 500 B.C. - present

Metals – gold

Plaster and wax models

Prosthetics of bone, ivory, wax, metals

Porcelains – late 1700's

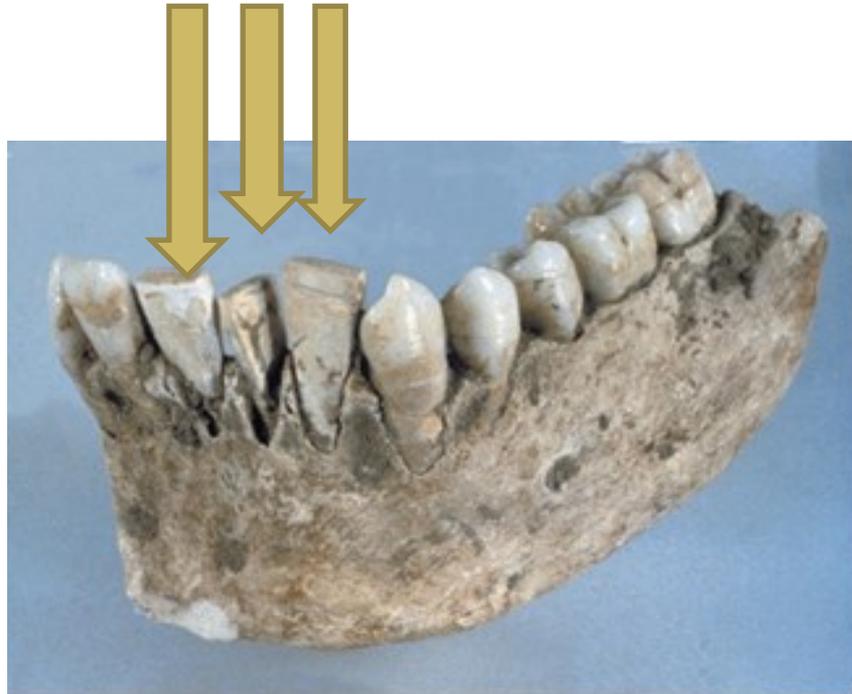
Amalgam – early 1800's

Acrylics – 1940's

Adhesive dentistry – 1970's - present

Digital dentistry CAD-CAM 1980





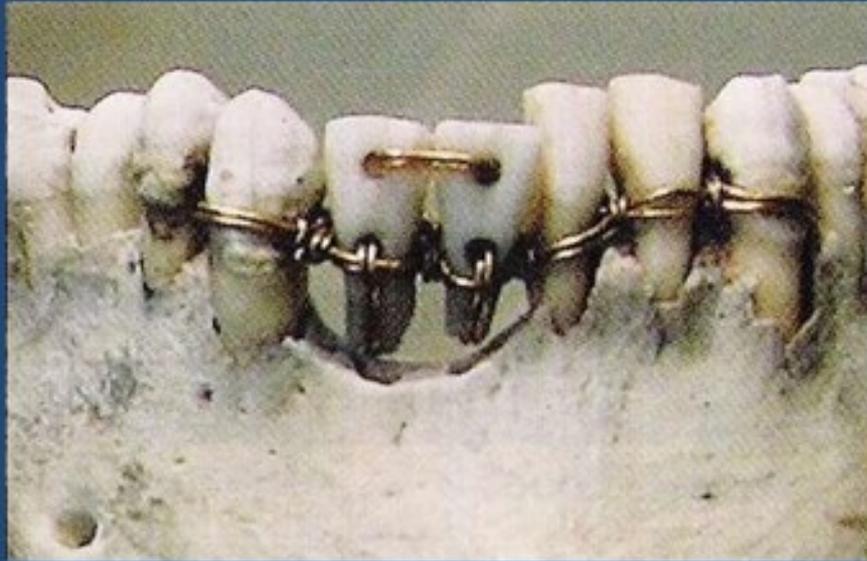
This mandible, dated 800 A.D., was found in Honduras. It shows three implanted incisors made of carved seashells. Calculus formation on these three implants indicates that they were not made solely for a burial display but served as fixed, functional, and esthetic tooth replacements. (Courtesy of the Peabody Museum of Archaeology and Ethnology, 33-19-20/254.0.)

Mayan jaw with stones and metal inlay decorations still intact on the teeth



Ancient Egyptian Bridge

BridgeAncient Egyptian

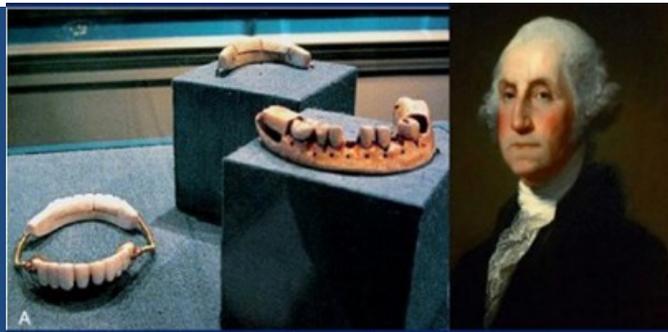


.Gold wire used to hold pontic crowns

BridgeAncient Egyptian



.Gold wire used to hold pontic crowns



- Spring-retained maxillary and mandibular dentures of U.S. President George Washington,
 - made from hippopotamus ivory by dentist John Greenwood.
 - Two of the first dentures made for the president using extracted human teeth

facebook.com/notesidental



High-Strength Crown Options

BruxZir [®] Solid Zirconia Crown	Gold Crown	Porcelain and Metal Crown

	veneers		bridge
	crown		Inlay →
	Onlay		



Characteristics of Ideal Materials

It should be

Biocompatible

Non-toxic, non-irritating, non-allergenic

Mechanically stable & durable

Strong, resistant to fracture

Resistant to Corrosion

Does not deteriorate over time

Dimensionally Stable

Little change by temperature & solvents



Characteristics of Ideal Materials

Minimal conduction Insulates against thermal/electrical change

Esthetics like oral tissue

Easy to manipulate

Minimal/reasonable effort & time needed

Adheres to tissues

Retains onto, and seals, tooth structure

Characteristics of Ideal Materials

Tasteless and Odorless

Not unpleasant to patient

Cleanable/Repairable

Easily maintained or fixed

Cost-effective

Affordability vs. benefits/disadvantages

General classification of all materials (According to composition)

All dental materials fall under 4 main groups:

Polymers.

Metals.

Ceramics.

Composites.



**Dental materials can be classified
(According to uses)as:**

1-Preventive dental materials.

2-Restorative dental materials.

A-Direct restorative dental materials.

B-Indirect restorative dental materials.

3-Auxiliary dental materials.

4-Temporary restorative dental material

1-Preventive dental materials

The preventive phase is very important. It includes **educating** the patient on how to maintain his oral hygiene through regular **brushing, flossing** and **periodic checkup** at the dental office. Regular brushing with a suitable brush and paste has been shown to be very effective at controlling caries as well as gum (**periodontal**) problems. The role of **fluorides** and fluoride therapy in the control of dental caries has been known to us for a long time. Fluoridation of drinking water and fluoride therapy at the dental office has played a significant role in reducing dental caries **especially in children**. Caries often begins in deep fissures in teeth. Fissure sealants is another preventive measure especially in children to prevent caries

1-Preventive dental materials

Basic aim is to provide resistance to the progression of an active carious lesion.

Carious lesion cause the demineralization of the dental enamel.

These include:

Chemotherapeutic agents like **Dentifrices**, **Mouthwashes** and cavity varnishes.

Pit and fissure **sealants**.

Fluoride releasing cements.



Drug Facts		Drug Facts (continued)
ACTIVE INGREDIENT	FLUORIDE	INDICATIONS
<small>Triclosan (0.06%) Sodium Fluoride (0.24%) Sorbitol (0.1%) Sodium Lauryl Sulfate (0.1%) Sodium Bicarbonate (0.1%) Sodium Citrate (0.1%) Sodium Hydroxide (0.1%) Sodium Phosphate (0.1%) Sodium Saccharin (0.1%) Sodium Stearate (0.1%) Sodium Sulfate (0.1%) Sodium Talc (0.1%) Sodium Zirconium Oxide (0.1%) Sodium Chloride (0.1%) Sodium Fluoride (0.24%) Sodium Lauryl Sulfate (0.1%) Sodium Bicarbonate (0.1%) Sodium Citrate (0.1%) Sodium Hydroxide (0.1%) Sodium Phosphate (0.1%) Sodium Saccharin (0.1%) Sodium Stearate (0.1%) Sodium Sulfate (0.1%) Sodium Talc (0.1%) Sodium Zirconium Oxide (0.1%) Sodium Chloride (0.1%)</small>	<small>0.24%</small>	<small>For the relief of toothache, tooth sensitivity, and tooth discoloration. Use as directed. Do not use if you are allergic to any of the ingredients. Do not use if you are pregnant or breastfeeding. Do not use if you are taking any other medications. Do not use if you are taking any other dental products. Do not use if you are taking any other fluoride supplements. Do not use if you are taking any other dental products. Do not use if you are taking any other fluoride supplements. Do not use if you are taking any other dental products. Do not use if you are taking any other fluoride supplements.</small>
WARNING		PRECAUTIONS
<small>Keep out of the reach of children under 6 years of age. If used in excess, fluoride may cause tooth discoloration or dental fluorosis. Do not swallow. Do not use if you are allergic to any of the ingredients. Do not use if you are pregnant or breastfeeding. Do not use if you are taking any other medications. Do not use if you are taking any other dental products. Do not use if you are taking any other fluoride supplements. Do not use if you are taking any other dental products. Do not use if you are taking any other fluoride supplements.</small>	<small>Do not use if you are allergic to any of the ingredients. Do not use if you are pregnant or breastfeeding. Do not use if you are taking any other medications. Do not use if you are taking any other dental products. Do not use if you are taking any other fluoride supplements. Do not use if you are taking any other dental products. Do not use if you are taking any other fluoride supplements.</small>	

2- Restorative dental materials

Direct restorative materials:

Used intraorally.

fabricate restorations / prosthetic devices directly on the teeth or tissues.



Indirect restorative materials:

Used extra orally.

Formed indirectly over a cast or models or Digital impression ,CAD-CAM....



2-Restorative dental materials

Help to repair or replace defected tooth structure.

A-Direct restorative These include:

Amalgam.

Bonding agents.

Resin based composites.

Compomers.

Liners.

Cement bases.

Dental polymers.



b-In-Direct restorative These include:

Cold, Ceramic, Zirconia, Acryl, Metal alloy

Amalgam

Also commonly named “**filling**”, the amalgam is a sealant made of small particles of silver, tin and copper

allied with mercury. Its mechanical properties and longevity has made it a **first choice for many years**. Its main flaw however is the fact that it contains **mercury** (admittedly in a stable form). Its **unaesthetic** aspect is also a shortcoming. This is why its use has become very limited in today's dentistry



Composite

The aesthetic fillings exist since a long time, but the recent development of composite resins made a great impact in dentistry. Today this material is the **first choice** in conservative restorative dentistry, thanks to the important progress made for pulp protection and in the adhesive techniques. The composite is inserted into the cavity and hardened with a polymerization lamp. These fillings are **sometimes sensitive to cold for a couple of weeks.** Composite is also used to seal permanently crowns and bridges

Gold

In dentistry gold is found in the form of gold alloys. It is an ideal material because of its **harmlessness**, **precision**, and **rigidity**, which is essential for important prosthetic realisations. It is mainly used for posterior reconstructions.

Grey gold is usually chosen because it is less visible.



Restorative dental materials

Indirect Restoration ●

A restoration that is created outside of the mouth on a model of the prepped tooth and later fixed into the mouth ●

Crown, bridges, inlay, onlay, veneers, complete, partial, dentures

,

Ceramics

Because of the vast aesthetic possibilities they offer, the ceramic restorations have become the choice of material in fixed prosthetics (Crowns and Bridges). Its drawback is that it is extremely hard and can sometimes fracture



Zirconium

Zirconium is mainly used for the framework of fixed prosthetics. It is a type of **CAD-CAM** ceramic used

in dentistry for the last 20 years, popular due to its **biologic compatibility** and its **aesthetic** properties. However, it is very expensive due to the advanced technology it requires.

Unfortunately it has given poor results in implantology and cannot be recommended in this field.

Titanium

It is used in **implantology** due to its **antiallergic** qualities. It can also be used in rare cases of metal allergy

with removable prosthetics



Metal Alloy

Steel (**chrome-cobalt**)

This material is used in removable prosthetics for framework and clasps (**nickel- chrome**) PFM, fixed prosthodontics



Acrylic resin

It is used to make the artificial gingiva in removable dentures. The teeth of dentures are made of acrylic resin or ceramics



3-Auxiliary dental materials

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

Impression materials.

Dental waxes.

Gypsum casts and model materials.

Finishing and polishing abrasives.

Acrylic resins for impressions.

Acid etching solutions.



4-Temporary restorative dental material

Sub category of restorative materials. Intended to be used to restore the tooth temporarily. These include:

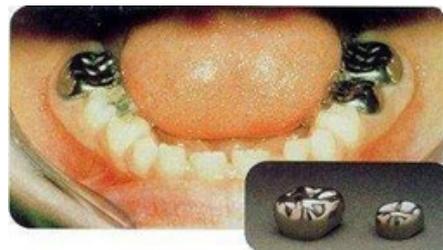
Orthodontic wires..



Cements used as temporary filling materials.

Acrylic resins used for Temporary inlays, inlays, crowns

and fixed partial dentures.



In Dental laboratory

Many materials are used in the dental laboratory to aid in the fabrication of stents, prostheses, appliances and other structures used in and around the mouth. These include cutting, abrading and polishing materials. Investment materials are used in the creation of moulds in the casting of metal structures. Waxes are used in various stages of construction of different structures. Gypsum products are used to make casts, models, molds and to secure articulators.

Summary

Materials used for dentistry are highly specialized. Each one is designed with a specific set of properties depending on what it is intended for. For example, materials used as tooth restorations should be able to withstand occlusal forces as well as bond to tooth structure. Impression materials should be highly accurate and stable in order to duplicate the original structure. Modern science, research and technology has provided dentistry with an ever- expanding selection of unique combinations of materials and techniques to serve dental treatment needs.



Do good for Others.....

It will come back in

unexpected ways