

## Working cast and die

**Working cast (master cast):** It is a replica of the prepared tooth (or teeth), ridge area, and other parts of the dental arch. It is obtained from the final impression, and on which the wax pattern is made (laboratory work).

### Requirements of good working cast:

1. It must reproduce all the details captured in the impression.
2. It must be free from air bubbles especially at the area of the finishing line and the occlusal surface.
3. It must be free from any distortion.
4. It should be trimmed at the margins of the prepared tooth (or teeth) to ensure access for carving of the wax pattern (ditching).
5. It should allow precise articulation.

**Die:** It is the positive reproduction of the individual (single) prepared tooth on which wax pattern is done. It is obtained from the final impression.

### Requirements of the die:

1. It must reproduce the prepared tooth exactly.
2. It must be free from air bubbles and voids.
3. It must return to its exact position on the cast when it is removed.
4. It must be stable even when the cast is inverted.

### Types of dies according to material's type:

The two critical properties of the die material are the dimensional stability (or accuracy) and abrasion resistance during the construction of the wax pattern.

1. Stone dies
2. Electroplated dies ( Silver-plated dies, Copper-plated dies).
3. Resin dies.
4. Amalgam dies.
5. Flexible dies.
6. Metal Sprayed dies

### Stone die:

#### Advantages of stone die:

1. Easy to be prepared.
2. Can be used with all types of impression material.
3. Cheap.
4. Need less requirements and easy to manipulate.

---

---

### **Types of dental gypsum products (according to ADA Specification):**

1. Type I: impression plaster.
2. Type II: model plaster.
3. Type III: dental stone.
4. Type IV: high strength dental stone (die stone).
5. Type V: high strength, high expansion.

### **Cast & die systems:**

1. Working cast with separated dies.
2. Working cast with removable dies:
3. DVA Model System and the Zeiser model system.

### **Interocclusal Record (Bite Registration)**

#### **Objective of bite registration:**

To transfer the relation between the upper and lower dental arches from the patient's mouth to the articulator we need bite registration. Proper interocclusal record is important to orient the die (s) of the same arch to the opposing arch.

When enough teeth are present in both dental arches we can transfer the relation by hand articulation of the casts. i.e., no bite registration is needed in such cases, so we can occlude the opposing casts by hand, and then we mount them on the articulator.

If the remaining teeth are insufficient to produce hand articulation of the casts, we have to record the bite by using either of the followings:

1. Pink base plate wax.
2. Bite registration paste.
3. Bite rim or occlusal rim.

#### **How to record?**

Whatever the material used to record the relation between the upper and lower dental arches, we have to guide the mandible to the required relation (centric or eccentric). So, the patient is asked to close and guide him, put reference points, and then we put the record material and register the relation.

The most widely used material to record the relation is pink base plate wax. The procedure is by softening the wax at first, then we ask the patient to bite on it, keeping in mind that we have to guide the mandible to the reference points that we have marked to have the correct bite registration. Meanwhile, the patient is asked to mold the wax at the lingual area by his tongue, while we adapt the wax on the labial and buccal sides by our fingers. After complete setting of the wax, we remove it from the patient's mouth, trim the excess wax, and attach it to the cast and transfer it to the articulator.

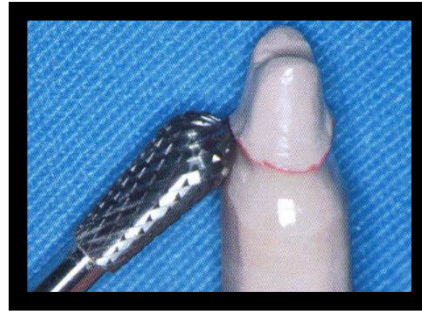
**Bite rim:** The bite rim is used in the following cases:

1. Free end saddle.
2. When we need to restore the anterior teeth.

When we don't have enough teeth to obtain the centric relation.

# Waxing

**Ditching**: before waxing, we should do **ditching**, which is the trimming of the stone that represents the gingiva around the prepared tooth in order to expose our finishing line which is located subgingivally or with the level of the gum. It is done by using a sharp hand instrument (sharp knife).



Cutting of the stone representing the gingiva to expose the finishing line (ditching)

**Waxpattern** : It is the precursor of the final cast restoration that will be placed on the prepared tooth.

## **Requirements of the wax pattern:**

1. It should be clean and smooth.
2. It should duplicate accurately the anatomical features of the original tooth.
3. It should be free from any debris.

Information needed for duplication of the anatomical features is taken from the adjacent teeth, the opposing teeth, and from general knowledge of dental anatomy.



## Why we use the wax for duplication?

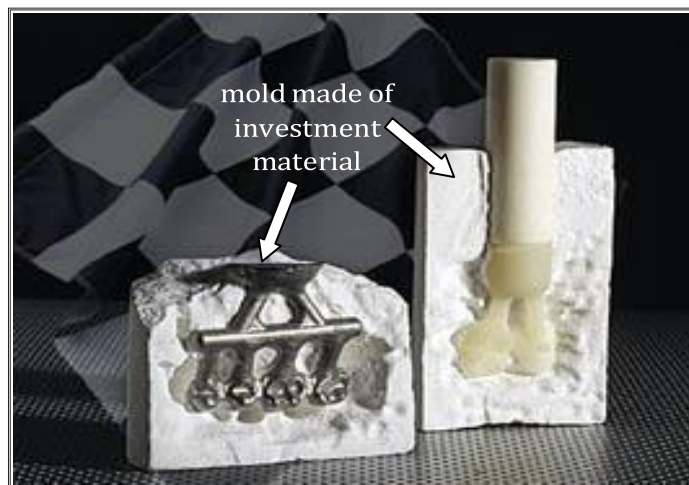
1. It is easily manipulated.
2. Inexpensive.
3. Easily eliminated from the mold cavity during the burnout procedure.



## Investing

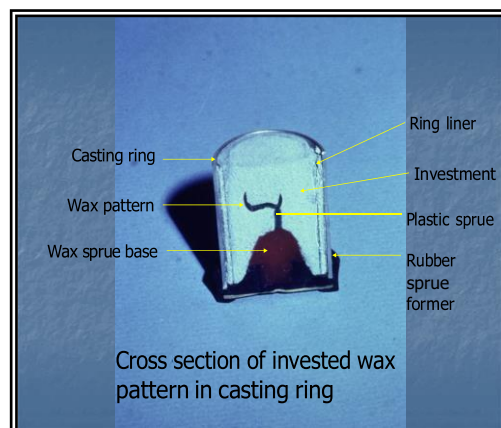
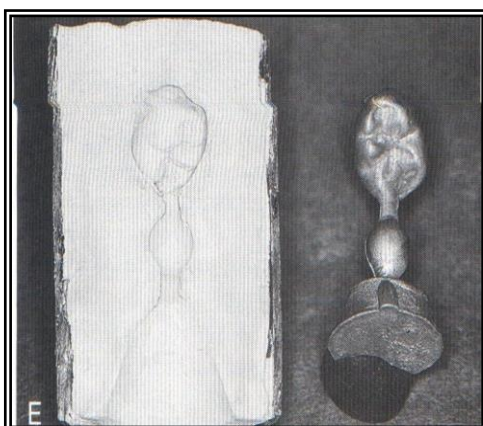
### Investing:

It is the surrounding of the wax pattern with a mold of heat resistant material that can accurately duplicate the shape and anatomical features of the wax pattern to obtain a mold after burning out the wax pattern.



### Mold Cavity:

It is the space created inside the investment after the burnout procedure which was occupied by the wax pattern, sprue and crucible former.



## Investment materials:

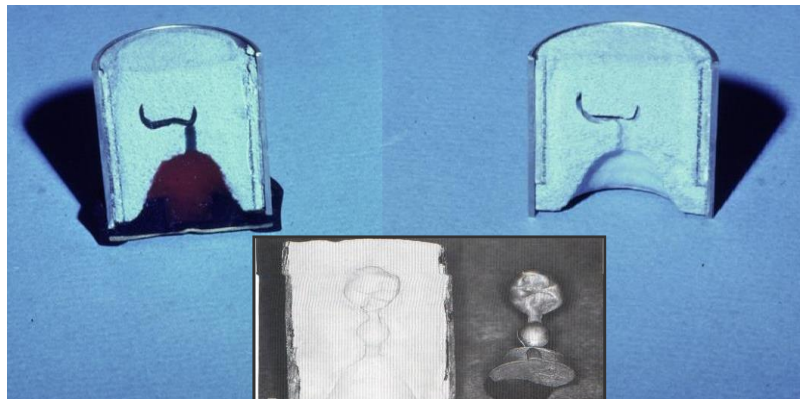
According to the type of the binder we have 2 types:

1. Gypsum-bonded investment material.
2. Phosphate-bonded investment material.

# Burnout & Casting

## Burnout Procedure:

It is the heating of the invested ring (casting ring) in a thermostatically controlled oven until the traces of wax are vaporized so that a mold cavity is created into which the molten metal can enter.



## Casting:

It is defined as introducing the molten metal into the mold cavity in the investing ring.

## Metal alloys used in the construction of cast crown restorations:

1. **Precious alloys:** these consist of at least 75% by weight noble elements. They involve gold alloys. According to ADA specification No.5, we have four types of gold alloys:  
Type I: soft.  
Type II: moderate. Type III: hard.  
Type IV: extra hard.  
Precious elements are gold, platinum, and palladium.
2. **Semiprecious alloys:** *Because* of the high cost of gold we can use these alloys such as silver-palladium alloy (60% Pd, 30% Ag).
3. **Non-precious alloys:** There are two main alloys which are nickel-chromium alloy (75% Ni, 15% Cr) and cobalt-chromium alloy (60% Co, 25% Cr). The phosphate bonded investment is used with these alloys to withstand their high melting temperature.

### Casting Equipment (Casting Machine):

The casting machine requires:

1. Heat source to melt the alloy.
2. Casting force to force the molten alloy to the mold cavity.

#### 1. Heat source:

The heat source can be either the reducing part of the flame produced from a pipe torch, or electricity.

#### 2. Casting force:

The casting force should be enough to overcome:

- i. The high surface tension of the molten alloy.
- ii. The resistance of gas within the mold.

The most common casting machine is the centrifugal casting machine which consists of a device for melting the casting alloy (crucible), and another part for throwing the molten alloy quickly by the centrifugal action into the mold cavity.

