CASTING PROCEDURES

Dr. Preeti Dubey, Subharti Dental College, SVSU
STEPS INVOLVED IN CASTING PROCEDURE

**STEP1:** Tooth preparation.

**STEP2:** Impression of the prepared tooth.

**STEP3:** Pouring the cast to form die.

**STEP4:** Fabrication of pattern on the die.

**STEP5:** Preparation of pattern for investment.
- Spruing the pattern.
- Attaching to crucible former.
- Placing in casting ring with liner.

**STEP6:** Investing the pattern.

**STEP7:** Burn out.

**STEP8:** Casting procedure.

**STEP9:** Recovery of casting, finishing and polishing.

---

Dr. Preeti Dubey, Subharti Dental College, SVSU
• **MASTER DIE**
  Positive likeness of a single tooth made by sectioning the cast which in turn is made out of an impression

• **MATERIALS USED FOR MAKING DIES**

  1. Gypsum products- Type IV Dental Stone
     Type V Dental stone
  2. Die stone - Investment combination
  3. Electroformed dies- Silver plated
     Copper plated
  4. Epoxy resins
  5. Polyurethane
Two fundamental ways to prepare a wax pattern for a dental restoration:

**Direct method**
- In this method, pattern is prepared on tooth directly in the mouth.

**Indirect method**
- In this method, a die of tooth is first made, and the pattern is made on die.

Dr. Preeti Dubey, Subharti Dental College, SVSU
Spruing the wax pattern

The purpose of attaching sprue former is to provide a channel through which molten alloy can reach the mold in an invested ring after the wax has been eliminated.

Sprue Former


Dr. Preeti Dubey, Subharti Dental College, SVSU
VARIABLES AND PRINCIPLES OF SPRUE FORMER DESIGN

- Materials use for spruing
- Sprue former diameter
- Sprue former attachment
- Sprue former position
- Sprue former direction
- Sprue former length
- Venting
- Reservoir
MATERIALS USED FOR SPRUING

- **Wax**
  - Most commonly used
  - Inexpensive
  - Easily burn out

- **Hollow metal**
  - Used for small inlays
  - Stronger than the wax sprue
  - Can’t burn out so carefully removed after investing pattern

- **Plastic**
  - Rigid than wax sprue former
  - Can burn out but may take longer time than wax to melt
SPRUER FORMER DIAMETER

- It should be of approximately the **same size** as the thickest area of the wax pattern.

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Diameter (in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>4.115</td>
</tr>
<tr>
<td>8</td>
<td>3.264</td>
</tr>
<tr>
<td>10</td>
<td>2.588</td>
</tr>
<tr>
<td>12</td>
<td>2.053</td>
</tr>
<tr>
<td>14</td>
<td>1.628</td>
</tr>
<tr>
<td>16</td>
<td>1.291</td>
</tr>
</tbody>
</table>

If the pattern is small, sprue former should also be small because attaching a large sprue to a thin pattern will cause distortion and if sprue is too small this area will solidify before the casting itself and localize shrinkage porosity may develop.

Dr. Preeti Dubey, Subharti Dental College, SVSU
Preferred Site of placement are on the:

- Occlusal surface.
- Proximal surface.
- Just below a nonfunctional cusp.
SPRUE FORMER LENGTH

Depends on the length of the casting ring.

Top of the wax pattern from open end of the ring should be

6mm - gypsum bonded investment.

3mm-4mm - phosphate bonded investment.


Dr. Preeti Dubey, Subharti Dental College, SVSU
Should be directed **away** from any thin or delicate parts of the pattern.

The sprue former **should not** be attached at a **right angle** to a broad flat surface.

**Ideally** sprued at a **45-degree angle** to the proximal area.
FUNCTION OF RESERVOIR

- It should be at a distance of 1-2mm from the wax pattern.
- It prevents localized shrinkage porosity in the casting.
- The resulting solidification shrinkage occurs in the reservoir bar and not in the prosthesis.

M.A. Marzouk, Operative Dentistry-1st edition

Dr. Preeti Dubey, Subharti Dental College, SVSU
Casting ring is used to invest the wax pattern in the investment medium.

Types
- Metal rings.
- Rubber rings.
- Split rings.
Ring liners line the walls of the ring to provide investment expansion.

Types

- Asbestos sheet.
- Fibrous ceramic aluminous silicate.
- Cellulose paper.
- Ceramic cellulose combination.
- GC NEW CASTING LINER.
Ring liners are placed to ensure uniform expansion in form of

- Normal setting expansion.
- Semi hygroscopic expansion.

The liner to fit the inside diameter of the casting ring with no overlap.
RINGLESS INVESTMENT TECHNIQUE

- With the use of higher-strength, phosphate-bonded investments, the ringless technique has become quite popular.
- The method uses a paper or plastic casting ring and is designed to allow unrestricted expansion.
Treatment of wax pattern

- The wax pattern should be cleaned of any debris, grease, or oils.
- A commercial pattern cleaner or a diluted synthetic detergent is used.
A pattern should be invested **as soon as** possible, after it is removed from the die, and it should not be subjected to warm environment during this interval.

In any case it should not stand more than **20-30 min** before been invested.
Dimensional changes Involved

- Dimensional changes occur in most of the steps of LOST WAX technique.
- The final restoration may not be exactly the same size as the pattern.

WAX SHRINKAGE + METAL SHRINKAGE

WAX EXPANSION + SETTING EXPANSION + HYGROSCOPIC EXPANSION + THERMAL EXPANSION


Dr. Preeti Dubey, Subharti Dental College, SVSU
INVESTMENTS

DEFINITIONS:

• Invest: To surround, envelop, or embed in an investment material.

• Investing: The process of covering or enveloping, wholly or in parts; an object such as a denture, tooth, wax form, crown etc. with a suitable investment material before processing, soldering or casting.
Classification according to Binders used:

- **GYPSUM BONDED INVESTMENT** – for low fusing alloys
  Casting of gold alloys inlays, onlays, crowns and fixed partial dentures.

- **PHOSPHATE BONDED INVESTMENTS**: - for higher fusing alloys
  Designed primarily for alloys used to produce copings or frame works for metal ceramic prosthesis and for some base metal alloys. It can also be used for pressable ceramics.

- **ETHYL SILICATE- BONDED INVESTMENTS**: for casting of removable partial dentures with base metal alloys (cobalt based or nickel based alloys)
CASTING PROCEDURE

• For casting procedure, we need
  Invested pattern
  Burnout furnace
  Molten metal
  Flame sources
  Casting machines
• Once the investment has set for appropriate period of 1hr it is ready for burn out
• The crucible former and any metal sprue former are carefully removed.
  • Any debris from the ingate area are cleaned with a brush.
If the burn out procedure does not immediately follow the investing procedure, the invested ring is placed in a **humidor at 100% humidity**.

If possible, the investment should not be permitted to dry out.

Plastic vials, as seen here, serves well as humidor when damp piece of paper towel is placed on bottom.

---

Dr. Preeti Dubey, Subharti Dental College, SVSU
The invested rings are placed in a room-temperature furnace and heated to the prescribed maximum temperature.

- For gypsum-bonded investments,
  - 700°C for the *thermal expansion technique*.
  - 500°C for the *hygroscopic technique*.

- *For* phosphate-bonded investments,
  - 700 to 1030°C.

Casting machines

Based on the casting processes utilized, different kinds of casting machines are available today.

- Centrifugal casting machine.
- High frequency centrifugal casting machine
- Direct current arc melting machine
- Vacuum pressure casting machine.
Generally two methods are employed for melting of metal alloy prior to casting:

- Flame / Blow pipe.
- Electrical.
After the casting has solidified the ring is removed and quenched in water as soon as the button exhibits a dull yellow glow.

Advantages of Quenching :

- The noble metal alloy is left in an annealed condition for burnishing and polishing.

- When the water contact hot investment, a violent reaction ensues, resulting in as soft, granular investment that is easily removed.
The surface of casting appears dark with oxide and tarnish. Such a surface film can be removed by the process k/a **Pickling**, which consist of heating the discolored casting in an acid.

**Pickling solution:**

- **Gypsum bonded investment:**
  
  50% hydrochloric acid.

- **Phosphate bonded investment:**
  
  cold HF acid.

Casting should not be held with steel tong.

Gold based and palladium based metal ceramic and base metal alloy are bench cool to room temperature before casting is removed from investment and then subjected to sandblasting, with fine alumina. Acid is not use for them.
Remove sprue with double sided diamond disc.

Polishing of gold casting is done with carbide burs, green stones, pink stone, tripoli or rouge.

Polishing of base metal alloy casting is done with aluminum oxide, tin oxide.


Dr. Preeti Dubey, Subharti Dental College, SVSU