Casting

Casting steps :

1- Melting the alloy
2- Casting technique
3- Recovery of the casting
4- Finishing

1- Melting :

* heat sources: reducing flame – electricity

a- blowpipe flame (torch)

- **conventional alloys** melted with **gas – air torch**

- **metal – ceramic alloys** melted with **gas – oxygen torch**

- **Base metal alloys** melted with **multi orifice gas oxygen or oxyacetylene torch**

* blowpipe flame zones :

1- **Melting zone** : colourless + contains pure gas
2- **Combustion zone** : green + flamed gas and air
3- **Reducing zone** : light blue + the hottest and least oxidizing (accepted for heating)
4- **Oxidizing zone** : reddish at the tip

b- **Electric** : well controlled – accurate – precise

By :

-Resistance heating : metal inserted in crucible surrounded by coil that carries high intensity current (convection)

- induction heating : high intensity induction current through the alloy

Note : induction is faster than resistance heating

Flux: reducing agent for gold alloys

- made from : borax powder “equal parts” + boric acid powder

*** Function of the flux:**

- Prevent oxidation

- reducing melting temperature

- Increase fluidity

* Note : Flux added after complete melting

2- Casting Techniques :

1- Air pressure : by compressed air or nitrogen gas
2- Vapour pressure : by wet asbestos to produce vapour that press molten alloy into the mold
3- Centrifugal : by centrifugal force (rotation)

* Casting Crucible: Porceline container where the alloy melted

- Crucible opening: at the posterior end through which the metal flows during casting.

- Crucible ending should be aligned with sprue opening in the investment ring.

Centrifugal casting machine (Steps):

1- Wind casting machine (clock wise turn)
2- The machine secured with the pin
3- Alloy added to the crucible + heated
4- Ring placed in the cradle where alloy kept molten
5- The machine allowed to spin
6- The ring is removed with casting tongs

3- Recovery :

* **Quenching** : the process in which the ring is plunged under running cold water into a large rubber mixing bowl .

- Gypsum- bounded investment disintegrate quickly due to sudden change in temperature

- Elimination of residue using teeth brush

-final traces removed ultrasonically

- Pickling : removing oxides using 50% hydrochloric acid

Note : Phosphate bounded investment don't disintegrate so it's remove by blunt instrument or by sandblasting using aluminium oxide.

4- Finishing and evaluation :

* **Finishing** :

1- Carefully inspect casting under magnification looking for tiny imperfections

2- Separate sprue from the cast using discs

3- Cast restoration finished by finishing stones and discs

4- Obtaining smooth surface by rubber wheel

* **Evaluation by microscope** for :

1- Accurate position of margins

2- Proper occlusal and proximal contacts

3- Proper alignment of axial surfaces

*** Polishing** : by soft bristles brush and polishing compound followed by a felt wheel and rouge

Casting defects

Common causes of casting defects:

1- No Casting :

a- Gate (sprue) obstruction: due to metallic sprue or investment fragments

b- Molten alloy not directed into the mold cavity

c- Premature solidification: low casting pressure – cold ring –incomplete melting

2- Defective casting :

a- Distortion b- surface roughness c- surface discoloration

A – Distortion of wax: the most serious problem

Avoided by :

- Incremental placing
- Avoid overheating
- Carve with sharp instruments
- Permit it to attain equilibrium
- Immediate investing after removal from die
- Placing it in ring's centre

B – Surface roughness: predominant imperfections on the surface.

- Causes:

- High L/P ratio
- Excess wetting agent
- Premature heating of investment
- Prolonged heating of the mold

Irregularities : isolated imperfections which is not a characteristic of the entire surface.

- Nodules (small or large , single or multiple)
- Water films -Fins

*** Nodules** : small air bubbles on wax pattern (small nodules)

- during or following investing (if during : bubble will be filled with alloy)
- Removal of margin and internal surface nodules will alter fitting which is wrong
- non-critical area's nodules can be easily removed
- Avoided by (elimination of incorporation of air):

1- Mixing under vacuum

2- Casting with Phosphate-bounded investment

3- removed by ½ or ¼ bur

* Large nodules : air-trapped during investment
* Multiple Nodules: due to inadequate vacuum during investing

Fins: caused by cracks in investment which results from:

- Weak mix of investment (high W/P ratio)
- Excess casting force
- Too rapid heating : steam
- Dropped ring after investment

*** incomplete casting:** too thin thickness (less than 0.3 mm)

- common in veneering or metal ceramic

- Causes:

- in adequate metal heating

- incomplete wax elimination

-Excess cooling (freezing)

- insufficient casting force

- insufficient metal

*** Voids and porosity:**

Caused by debris trapped in the mold

- Internal porosity = weakness

- Eternal porosity = discoloration

- Suck back porosity: when metal in sprue solidify before metal in the mold due to :

- too long sprue - too thin sprue -incorrect sprue location

- Inclusion porosity: when particle of investment dislodge during casting

- Back pressure porosity: by air pressure in the mold which can be avoided be :

- More porous investment

- Wax pattern located at near end of the ring (6-8mm)

- Vacuum casting technique

*** Marginal disappearance**: inaccurate fitting of restoration at margins which caused by:

- Distortion of wax pattern

- Uneven mold expansion

*** Dimensional inaccuracy** : Too small or too long casting

Caused by: improper expanded mold

Avoided by :

- Proper L/p ratio
- Proper heating to compensate casting shrinkage