Soldering & welding

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SOLDERING

- Soldering is the joining of two metals by the use of filler metal which has a substantially lower fusion temperature than that of the metal parts being joined

- Fusion temperature of filler metal ≤ 450° c

History of soldering

- There is evidence that soldering was employed up to 5000 years ago in Mesopotamia. Soldering and brazing are thought to have arisen very early in the history of metal-working, probably before 4000 BCE .
- Sumerian swords from ~3000 BCE were assembled using hard soldering
- Soldering was historically used to make jewelry items, cooking ware and tools, as well as other uses such as in assembling stained glass.

- **Brazing (same procedure)**

Fusion temperature of filler metal ≥ 450°c

To solder ….

- 2 or more metal parts
- Solder or filler metal
- Heat
- Flux
- Anti flux

Dental solders

Dental solders are alloys used as intermediary or filler metals to join two or more metallic parts.

Composed of gold, silver, copper, zinc, tin, nickel

REQUISITES OF A SOLDER

1. Good tarnish & corrosion resistance in mouth
2. Fusion temperature should be lower than that of parts being joined. (50°-100°c less)
3. Should be free flowing and adequately wet the metal parts for good adhesion
4. Strength of solder comparable to metals being joined
5. Colour of solder should match with parts being soldered

TYPES OF SOLDER

SOFT SOLDERS

HARD SOLDER

SILVER SOLDER

GOLD SOLDER

FLUX

Flux: in Latin means ‘flow’

- Removes oxide coating to increase flow of the molten solder
- Dissolves any surface impurities
- Prevents oxidation of metals
- Reduces melting point of dental solder

Flux materials:

- Borax fluxes-use with noble metal alloys.

Composition

1) borax glass-55%
2) boric acid-35%
3) silica-10%.

- Fluride fluxes -use with base metal alloys.

Composition :

1)boric acid-50%

2) potassium fluride-50%.

Choosing the proper flux

- The choice of flux is dictated by the type of alloy to be soldered, not by the type of solder used.
- If the alloy contains chromium such as stainless steel wires for orthodontics or cobalt-chromium alloys for partial dentures, the proper choice is fluoride flux.
- If noble alloys are to be soldered, the proper choice is borax flux.
- Mode of supply – powder form or paste

Form.

Types of flux

- Type 1 flux- **Surface protection**- covers the metal surface and prevents access to oxygen so no oxides can form.
- Type 2 flux- **Reducing agent**- reduces oxides and exposes clean metal. Borate flux are type 1 and type 2
- Type 3 flux- **Solvent**- dissolves any oxides present. Eg, fluoride fluxes to dissolve chromium oxide.

Pre fluxed solder

- Filler or solder metal in tube form.
- Flux is inside the tube.

ANTIFLUX

Material used to confine the flow of molten solder over metals being joined

Graphite, lead, pencil marking, iron rouge

Types of soldering

- Investment soldering – large area, precision

- Free hand soldering – small area, common in orthodontics

Steps

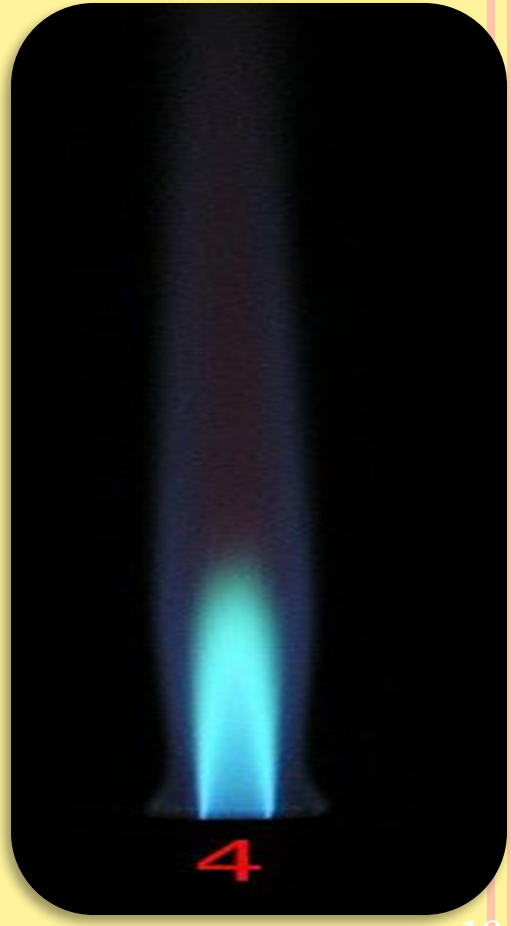
1. Clean surfaces
2. Assemble parts
3. Select right solder and flux
4. Select proper joint – point
5. Apply flux, anti flux
6. Heating and introduce solder
7. Quenching

Heat sources

- Flame – hydrogen, natural gas, propane
- Oven or furnace

- Zones of flame

1. Mixing zone –cold, inner
2. Combustion zone (oxidizing)
3. Reducing zone (blue)- use this
4. Oxidizing zone –hottest, burnt gas, outermost



SOLDERING DEFECTS

1.PITTED SOLDER JOINTS:

- Results from either improper heating of solder are with improper fluxing during heating.
- If solder is heated too high for a prolonged periods, the lower melting point tin and zinc in the solder can boil and form oxides and form pits and porosities

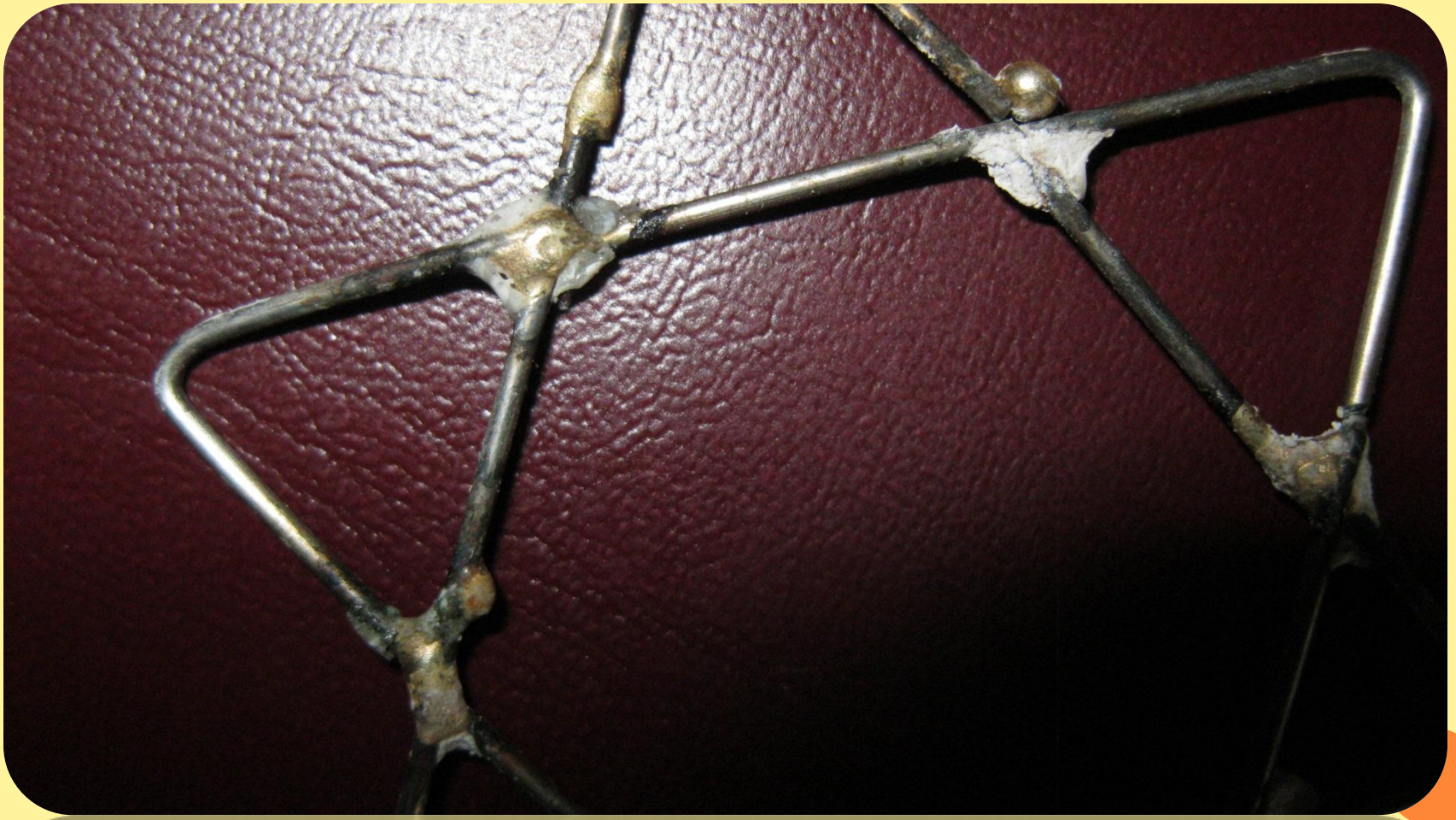
- If the solder is under heated and the flux is applied in excess and if it is improperly melted, it may be trapped in the melted solder and form pits.
- The pitting or porosities may also result from incorrect cleaning and incorrect spacing of parts.

2. FRACTURE OF THE JOINT:

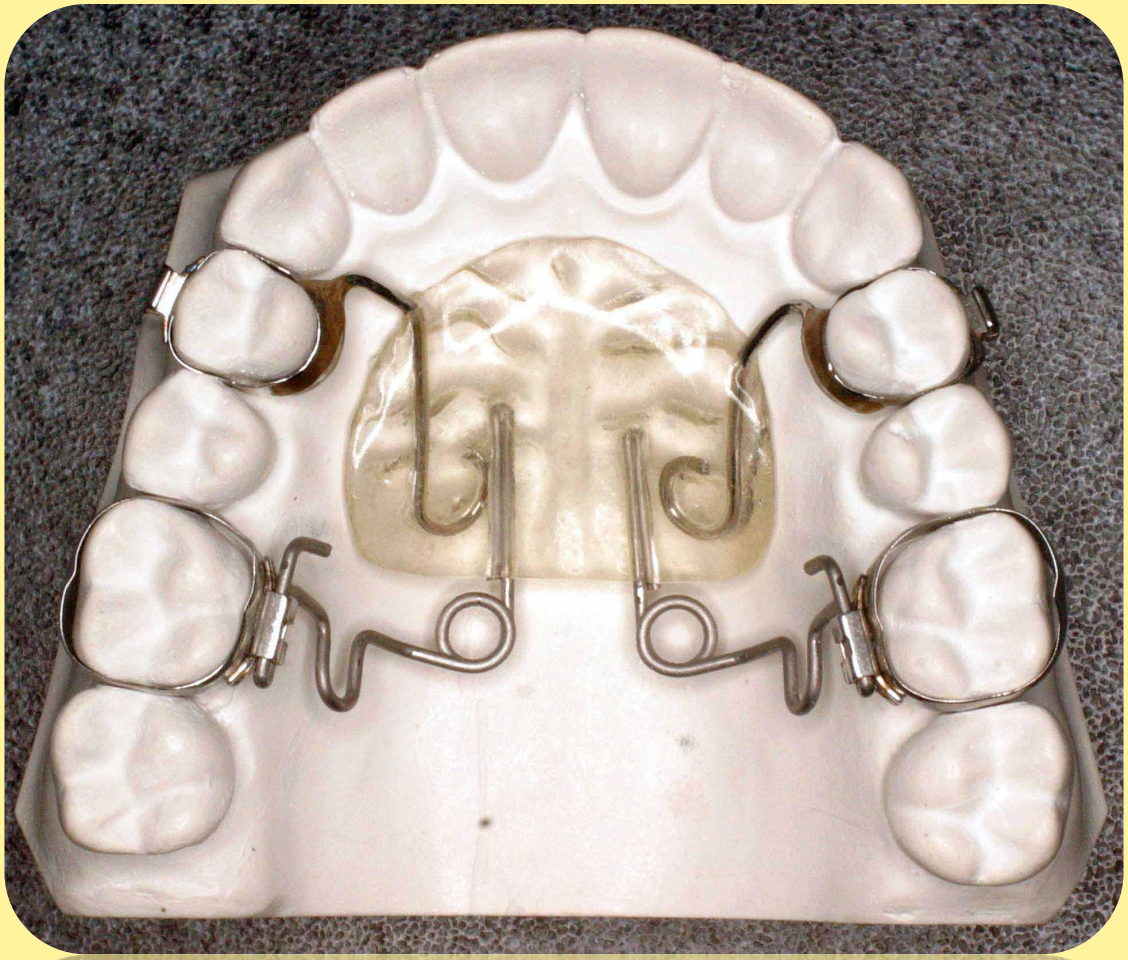
- Fracture of the joint may happen due to over heating.

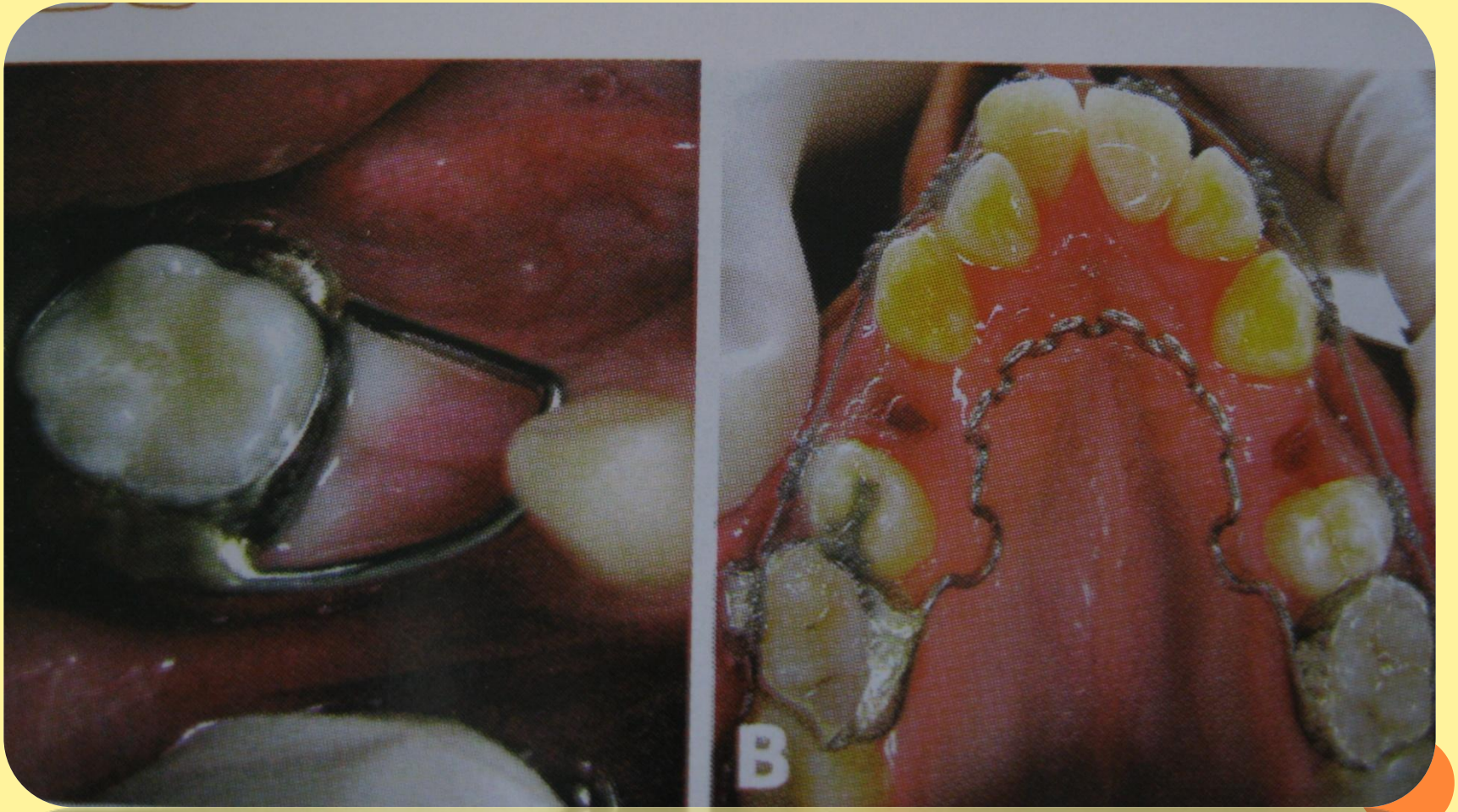
3.DISTORTION OF THE PARTS BEING SOLDERED:

- Over heating.
- Thermal expansion of the metal parts.



Applications in orthodontics

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Welding

- Welding is process by which 2 or more metals are joined using heat / pressure or both but without use of filler metal.
- No filler metal

2 Types

Cold welding- done by hammering or pressure, ex- gold foil

Hot welding- Heat of sufficient intensity to melt metals being joined. Ex- spot welding in orthodontics

3 METHODS OF WELDING USED IN DENTISTRY

1) Spot welding

2) Pressure welding

3) Laser welding

Principle of spot welding

- Heat and pressure are 2 basic principles
- Electrodes hold metal, apply pressure , conduct current and heat
- Duration of current – less- 0.1 sec, electric timer

Steps in welding

- Select proper electrode- broad for thin material and vice versa
- Clean electrode
- File if needed
- Place metals between electrodes
- Press switch

Pressure Welding

Metal parts placed together

Sufficiently large force applied perpendicular to the surface- welding occurs

Force applied should be sufficiently large

Laser Welding

- High intensity pulse of light that can be focused
- Select duration & intensity of pulse- metal melts in small region without micro structural damage to surrounding areas

Applications

Welding

- Joining parts
- hook to Adam's clasp
- Attachments to bands
- To make bands
- Fixing tubes to bands

THANK YOU