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A LITERATURE REVIEW ON VARIOUS DIE MATERIALS AND DIE SYSTEM

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Abstract : -
For the fabrication of the successful fixed dental prosthesis, accurate duplication of the tooth that is prepared in the mouth is very much essential. The final clinical success of the fixed dental prosthesis, depends upon the accuracy of the impression, durability of the die. Most of the clinicians faced problems with fit of long span fixed dental prosthesis. Clinicians usually faced problems in relation to sectioning of long span fixed dental prosthesis. These steps also increased in chair time of the dentist as well as the patient, increase the cost of the procedure. To reduce the number of the clinical steps, accuracy of the working cast should be enhanced, by choosing a impression material with good reproduction details, improving the accuracy of the die system also results in accurate fit of the fixed dental prosthesis. A cast die system helps in capturing the necessary information, which can be transported to the laboratory [1-3].

Keywords: -Die system, pindex system, die materials, die pins, accutrac system .

Introduction : -

Different synthetic materials has been into the use since years for the replacement of the missing teeth in the oral cavity. With the introduction of the implants into the dentistry, requirement for accuracy for the working cast model has been redefined. It is found to be very much inconvenient, difficult and as well as time consuming, for the fabrication of the wax pattern for the extra coronal restoration in the oral cavity. Most of the times, fabrication of the wax patterns done in the laboratory, with the help of the indirect technique. For the fabrication of the wax pattern with the help of the indirect technique, accurate reproduction of the prepared tooth along with the soft tissues are required, for the proper fit of the fixed dental prosthesis. A cast die system helps in capturing all the necessary information, which can be transferred to the laboratory for the fabrication of the fixed dental prosthesis and implant supported prosthesis[5-9].

A die can be defined as a positive reproduction of the form of a prepared tooth or teeth, in to any suitable substance. And the replica of the prepared tooth or the teeth , along with surrounding ridge areas, and other parts of the dental arch is known as a working cast.
Die pin can be defined as a metal pin which is used in stone cast to remove the sections of the die and replace them accurately in the original position[4-7].

Requirement for a die : -

- All the surfaces have to be duplicated as it is with no bubbles and no voids.
- Details of the prepared tooth should be reproduced as it is, from all the manners.
- Margins should be adequately accessed.

Requirement for the die material : -

- Die material should be accurate
- Die material should be dimensionally stable
- Die material should have a smooth and hard surface.
- The surface of the die material should not be easily abraded.
- Die material should be compatible with the impression material.
- Die material should bears a high strength.
- Die material must have a good contrast of the color.
- Die material should be economical.
- Die material should be easy to handle or manipulate
- Die material should have ability to reproduce even the finer details,
- Material should have the ability to reproduce the finer details [5-9].

Selection criteria for a cast die system

- The material should allow the formation of a dimensionally stable as well as accurate cast.
- The material should be strong and it should be resistant to abrasion.
- It should be easily sectionable.
- It should be easy to trim.
- it should be completely compatible with the separating medium to avoid the sticking of the wax pattern with the cast.
- It should be able to reproduce the surface details accurately and exactly.
- Material should be available in color contrast with the wax which is used, to see the margins of the preparation accurately and exactly.
- It should be compatible with the impression material used[3-9].

Material used for the fabrication of the die are as follows

Gypsum products, amalgam dies, epoxy resin, electro deposition of metals, flexible die materials, refractory materials for die preparation, silico phosphate dies, ceramic dies, metal sprayed dies, low fusing alloys.

Gypsum products dies

Gypsum products are found to be the most commonly used die material. There are five basic types of gypsum, namely impression plaster, dental plaster, dental stone, dental stone high strength, high strength and high expansion dental stone. The difference which has been found in various types of gypsum products are attributed to the process of calcination. Surface detail reproduction is found best with dental stone high strength i.e.type iv, and dental stone high strength and high expansion i.e. type v. these two different types of gypsum materials are capable of reproducing 20μm wide line according to specification no. 19 of American dental association.

Advantages of gypsum products are as follows

- They are usually compatible with all types of different impression materials.
- Have the ability to reproduce the finer details with the sharp margins, well.
- Gypsum products provide good dimensional stability and accuracy.
- Very easy to use and manipulate.
- The main dis advantage of gypsum products are, they can be easily abraded[3-7].

Amalgam dies

They provide superior strength. They provide better resistance to abrasion and helps in reproducing finer details along with the sharp margins. The main disadvantage of amalgam dies are, they can be packed in to rigid impression material only, usage of amalgam dies is a time consuming procedure, amalgam dies can lead to distortion of wax pattern, amalgam dies show high thermal conductivity.

Epoxy resins

Epoxy resin material have also been used for the fabrication of the dies for the preparation of inlays, crowns , bridges, with the help of indirect technique. Epoxy resins provide with more resistance to the abrasion, they found to be less brittle as compared to the stone dies, and the main advantage of the epoxy resins are, they can be carved easily at the room temperature. The main disadvantage of epoxy resins includes polymerization shrinkage, they found to be less stable dimensionally, they are more prone to trap air bubbles, and dies fabricated from epoxy resins are expensive.

Electroplated dies

Dies which are formed with the help of electroplating are commonly used in the fabrication of the ceramic restoration and pfm restoration, that too particularly for full mouth rehabilitation cases. Electroplating dies provide better resistance to abrasion than stone dies, it provides better reproduction details. The disadvantages of using electroplated dies are, more time consuming procedure, special type of equipment is required while using electroplated dies, and electroplated dies are not usually compatible with all the impression materials.

Another type of die material is flexible die material, it provides rapid setting and provides easy removal of the restorations which are provisional.

Metal sprayed dies

Which consists of alloy of tin and bismuth, can be sprayed directly on the impression, which results in formation of metal shell, which can after than be filled with the help of dental stone. The main advantage of the metal sprayed dies are they can be obtained rapidly from the elastomeric impression material. And the main disadvantage of the metal sprayed dies are special care is needed to prevent the abrasion of the die[7-12].

Different cast and die systems : -

1) Working cast made with a separate die
2) Working cast made with die which is removable.

Working cast made with a separate die

This method is found to be the simplest method. The main advantages of using this method is, it is very easy to fabricate, maintains the relations fixed in between the abutments . the main disadvantage of using this method is, there can be distortion of the internal adaptation of the wax pattern, during the transfer of the wax pattern to the cast from the die,

Working cast and sectional die, both can be obtained, by pouring the impression twice and by making two different impressions.

Procedure : -

For the preparation of separate die, stone should be add in small increments, large amount of stone should be avoided, if large amount of stone is used in the preparation, there will be chances of voids formation, due to entrapment of the air, height should be at least one inch. After than step of ditching should be done, which includes, highlighting of the finish line with the help of red pencil, die should be taken away, and the stone which is in excess and present near to the gingival area to the finish line should be trimmed with the help of no. 25 blade, or with the help of acrylic bur which is pear shaped in nature and handle which is made should be of one inch in length. After than die spacer should be applied, the main role for the application of the die spacer is to provide space for cementation of the final restoration in the oral cavity. It helps in adaptation of casting over the die so accurately. Thickness of die spacer should be 10 to 15 μm. Die lub which is a die lubricator can be used to coat the die over the die spacer directly. It facilitate so easy removal of the wax pattern, that too without adherence of wax pattern to the die[5-8].

Working cast with removable dies

The main advantage of this die system is, this is very convenient to use. The only disadvantage of this system is, there will be occurrence of error in the pattern, if the die is not seated over the cast accurately. Devices are oriented in to the impression before it gets poured in the pre pore technique. For e.g. conventional dowel pin system. And the other technique is known as post pore technique, in which it is attached to the underside of the cast that has already been pored. For example, pindex system.

Dowel pins

Different types of anti rotational dowel pins are as follows
Single dowel pins flat sided
Curved dowel pins single
Dowel pins double with single head
Two separate dowels parallel
Pindex system
Keyed plastic outer tray

Straight dowel pin

Different items can be used for orientating the dowel for example anesthetic needle, bobby pins, paper clips. Flat sided straight dowel pin of brass is commonly used in preparing the die. Serrano J.G. et al stated that it is found to be most accurate in resisting horizontal and vertical movements. By placing the dowel at incorrect angle may result in removable of the die impossible. Stabilize the dowel pin with the help of bobby pin and stabilize the bobby pin with the help of straight pin and with the help of sticky wax. Now pouring of the die stone in the impression is done, and filling the impression of the teeth covering the dowel pins. Lubrication of the stone should be done around each dowel with the help of the lubricating jelly, for the easy removal of the die from the cast. When it is set, base is trimmed for the removal of the excess. saw frame with the help of the blade is used to the cut the die stone. Cut should be placed on the mesial and distal side of the die, they should be parallel to each other[3-6].

Curved dowel pin be used by pre pour and post pour technique, for both the techniques.

Pre pour technique

The tail of the dowel pin should extend on the facial site. Straight pin should be inserted in to one of the three holes on the facial side of the bar, along in to the facial flange of the impression. And another pin should be inserted in to the lingual flange from the lingual side. It should be parallel to the long axis of the tooth which is prepared. One pin should be prepared in the center of the unprepared tooth to easy removal of the segment. Impression should be poured with the help of the die stone till it covers the dowel full. Lubricating jelly should be applied over the set stone and on

the dowel part which is exposed for the easy removal from the base. Impression should be boxed and poured with the stone. After than with the help of the saw along with the blade cuts are made on both the sides of the tooth that too without damaging the configuration of the finish line.

Post pour technique

Pouring of the impression with the help of the die stone is done. after than drilling of hole with dimension of 0.5mm is done , below and at the center of the each prepared tooth, and the pontic area and also on the unprepared tooth segment. After than insertion of curved dowel pins should be done properly and check for the accurate fit. Head should be inserted properly and the tail should be facing facially. Than whole procedure is repeated for the pouring and the trimming.

Di lok tray system

This system utilizes a snap plastic tray which is having internal orientating grooves, which is used to re assemble the die and the cast. According to Dilts, Podshadly this system is having least vertical errors.

The pindex system

This system utilizes brass dowels and plastic sleeves. A cast is poured and allow the cast to set for sixty minutes. Than the cats is trimmed with maintain a height of the cast at 15mm. with the help of the pencil mark the point in the center of the tooth, at which hole should be drilled. Cats is placed over the system and a red light is placed over the center of the tooth, below which the hole need to be made, by pressing the cast over the table, hole is drilled over the exact below position of the cast, where the light is falling. Short pins are cemented on the lingual side along with the palatal side and long pins are cemented over the buccal side. After the cement gets dried, apply plastic sleeves over the pins. Petroleum jelly is applied as a separating medium for the easy removal. With the help of the saw, cuts are made on the mesial and the distal end of the desired tooth [2-9].

Accutrak system

This system mostly used for the fabrication of the veneers. This system is basically a modification of the plastic tray which is having internal orienting grooves. Other system which is known as zeiser model system, this system mainly allows the expansion of the stone, which is than relieved by the cuts given by the saws.

Conclusion

The choice of technique is totally rely on the clinician preference,. If the method are conducted carefully all method achieve acceptable accuracy which in results provide better adaptation of the prosthesis in manners of functions and esthetics.

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