Use of Agar as a Dental Impression Material

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Abstract

Agar hydrocolloid was the first successful elastic impression material to be used in dentistry. It is an organic hydrophilic colloid extracted from certain types of seaweed. It is a reversible impression material because of its property of reversing their physical state, which is reusing the impression material for multiple number of impressions. It was initially known as "Negacol", later termed as "Dentacol" when introduced into dentistry.

Keywords: *Agar, hydrocolloid, impression, Reversible.*

Introduction

Impression materials are used to record the intraoral structures for the fabrication of dental prostheses. Accurate impressions are necessary for the construction of any definitive restorations. The accuracy of these final restorations depends greatly on the impression materials and techniques. Impression materials should accurately reproduce the hard and soft tissues to obtain biologically, mechanically, functionally, and aesthetically acceptable restorations [1].Hydrocolloids have a high hydrophilic nature that allows this material to capture accurate impressions even in the presence of some saliva or blood. It has a low wetting angle so it easily captures full arch impressions. It has moderate ability to reproduce detail and costs relatively little compared with other impression materials. The two types of hydrocolloids used in dental impressions are agar and alginate. Agar is a reversible hydrocolloid because it can pass repeatedly between highly viscous gel and low viscosity sol simply through heating and cooling. Agar-agar is an organic colloid derived from the cell wall of red seaweed [2]. It is essentially a hydrophilic, emulsoid polysaccharide [2]. Reversible hydrocolloid was introduced to the dental profession in 1925 by AlphonsPoller, an Austrian as impression material [3].Agar was first introduced into dentistry for recording crown impressions in 1937 by Sears [4] and was the first elastic impression material available. It was termed as "negacol" or "dentacol" when introduced into dentistry.

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Applications in Dentistry

The following are the various uses of agar in dentistry [5-6]:

1. Recording secondary impression for inlay, onlay, crown and bridge work

2. Making agar-alginate impression (Laminate impression technique)

3. Laboratory duplication of stone casts

4. Help in making acrylic dentures using the fluid resin technique

5. Used as tissue conditioners

Composition

The following is the composition of agar agar impression material [7]

1. Agar (12-15%)

2. Water (85%)

3. Borates (0.2-0.5%) (strengthening agent)

4. K_2So_4 (1-2%) (to overcome the retarding effect of borax on gypsum cast material)

5. Thymol (Antifungal)

6. Coloring agent and flavour

7. Fillers (0.5-1%) (diatomaceous earth, silica, wax rubber)

PROPERTIES

Irreversible hydrocolloid impression material has dimensional changes as a result of syneresiswhen exposed to air[8].Storage medium such as 2% potassium sulphate solution or 100% relative humidity in a storage chamber, is suggested to reduce the dimensional change of agar impressions[9]. While Alginate has a Compressive strength of 5000-8000gm/cm2 and Tear strength of 350-700gm/cm2 [10], Agar has a Compressive strength of 8000gm/cm2 and Tear strength of 7000gm/cm2 [11]. This material does not readily flow into areas in which the tray does not extend. If distortion occurs, corrections cannot be made and this is a major drawback [12]. Agar is sufficiently fluid to allow detailed reproduction of hard & soft tissue. If the material is held rigidly to the tray, then the impression material shrinks towards the centre of its mass. Rapid cooling may cause a concentration of stress near the tray where gelation first occurs. The sodium sulphate that was formed as a by-product of the setting reaction of the alginate is a gypsum setting retarder at high concentrations and thereby produce poor surfaces [13]. Agar impression material contains borax, which is a retarder for setting of gypsum. This can be overcome by immersing the agar impression in a solution containing a gypsum accelerator or by incorporating a gypsum surface hardener. Most alginate impressions are not capable of producing finer details whereas agar produces an accurate impression in comparison [14]. The combination of agar and alginate appears to produce excellent results and detailed accuracy overcoming the drawbacks of both the materials.[15]

SETTING REACTION

Agar behaves as a thermoreversible gel and the sol-gel formation is reversible which is temperature dependant. This material forms a colloid after absorbing water, which liquefies between 71°C and 100°C and sets to a gel again between 30°C and 50°C, depending on the concentration of the agar [10]. The setting of the reversible hydrocolloid is called gelation.

MANIPULATION AND IMPRESSION MAKING

At first, reverse the hydrocolloid gel to the sol stage. Boiling water is a convenient way of liquefying the material. The material must be held at this temperature for a minimum of 10 minutes. Propylene glycol can be added to the water to obtain the temperature of100^{o}. There are three compartments in the conditioning unit, making it possible to liquefy, store and temper the material. The hydrocolloid is usually supplied in two forms: syringe and tray materials. After it has been liquefied, the material must be stored in the tray. The impression trays are rim locked with water circulating device. This type of tray allows a space of 3mm occlusally and laterally and extends distally to cover all the teeth. The syringe material is taken directly from the storage compartment and applied to the prepared cavities. It is first applied to the base of the preparation and then the remaining teeth are covered. By the time the cavity preparation and adjoining teeth have been covered, the tray material has been properly tempered and is now ready to be placed immediately in the mouth to form the bulk of the impression. Gelation is accelerated by circulating cool water, approximately, 18 – 21^{o}through the tray for 3 – 5 minutes. [7,9,13]

DISINFECTION

For disinfecting the impression, iodophor, bleach or gluteraldehyde can be used. The hydrocolloid may be disinfected by 10 minute immersion in or spraying with the antimicrobial agent such as sodium hypochlorite and glutaraldehyde without sufficient dimensional change. [14,15,16]

RECENT TECHNIQUES

Wet field technique

The oral tissues are flooded with warm water. The syringe material is then injected in to the surface to be recorded. Before the syringe material undergoes gelation process, tray material is seated. The hydraulic pressure of the viscous tray material forces the fluid syringe material down in to the areas to be recorded. The motion displaces the syringe material as well as blood and debris throughout the sulcus.

Laminate technique

The general procedure is to heat the agar to be placed into re-usable syringes for about six minutes in boiling water. The agar is stored for at least 10 minutes at 65°C before being syringed around the preparations. A mix of alginate containing 10% more water than normally recommended is placed in a tray and it is immediately seated over the agar syringe material.[17] The cool mix of alginate helps gel the agar, and when the alginate has set, the combined impression is removed. The technique simplifies the use of agar and provides an impression surface that allows for preparation of stone casts acceptable for crown and bridge applications [18]. Advantages of this technique are that it isinexpensive, no odour, non-toxic and non-staining. Disadvantages include complexity of the technique and lower than desirable tear strength.

ADVANTAGES

· It helps in accurate die preparation.

· It has good elastic properties and reproduces most undercut areas correctly.

· It has good recovery from distortion

· It is not hydrophobic and hence gives good model surface

· It is palatable and well tolerated by the patient

· It is cheap when compared to synthetic elastic materials

· Agar can be re-used when used as a duplicating Material (Re-use is not recommended when used as an impression material)[7]

DISADVANTAGES

· Does not flow as good as the newly developed materials.

· It cannot be electroplated.

· Due to the heat it may be painful to the patient during insertion or gelation.

· Tears relatively easily.

· Greater gingival retraction is required for providing adequate thickness of the material.

· Only one model can be poured.

· Expensive equipment is required.

· A plaster hardener should be used to get a soft surface on gypsum cast contamination is very prevalent with this material due to re-use and the lack of sterilization technique. [7]

Conclusion

Making impressions is an important part of indirect restorations that is often overlooked. The increased use of agar impression material as a result of the development of the agar alginate combination technique should level off and continue at a modest level. With the selection of an appropriate impression material and impression technique, impression taking is reliable and reproducible, with consistent successful results.

Ethical Clearance – Not required since it is a review article

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Conflict of Interest – Nil

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