

Dimensional Stability Analysis of Different Types of Alginate

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Irreversible hydrocolloids, molding.

Abstract – Irreversible hydrocolloids, or simply alginates, are the most used molding materials in different areas of dentistry, due to their ease of handling, low cost and good reproducibility. The present work aims to analyze the dimensional stability of different types of alginates at different time intervals. It is applied research, in which its approach was qualitative-quantitative, of an exploratory nature. Three different brands of alginate were used, where a standard dummy was molded and the leakage happened immediately: G1 (n: 10) Hydrogun, G2 (n: 10) Jet Plus and G3 (n: 10) Ava gel. With the digital caliper, the distances were measured and compared with the standard model, the data obtained were tabulated, analyzed using parametric tests and the areas of each model were added. As a result, the area of the standard model was similar in both groups. It is possible to conclude that the type of alginate did not interfere with the distortion of the standard model.

I. INTRODUCTION

When performing the molding, the mold used in the production of dies models is obtained, which are a very important step for several dental procedures. From a negative copy of the dental arches, it is possible to obtain the models for planning the treatment to be performed. The models must be faithful to the oral anatomy, being essential the adequate choice of impression material, correct manipulation and waiting time for it to reach the desired consistency, are important phases for the faithful reproduction of the model (Anusavice et al., 2012).

Irreversible hydrocolloids, or simply alginates, are indicated for mold making to obtain the model, both for study and work (Da Costa et al., 2017). It is known that alginate is an extremely fragile material, therefore, in the handling process, precision is essential in relation to its properties, such as the powder/liquid ratio, also in the execution of molding and casting in plaster, as these details can interfere in the final dimensional stability of the model (Faria et al., 2008).

About 85% of alginate is composed of water and is subject to distortion caused by expansion associated with drinking (moisture absorption) or syneresis (moisture loss). As a result, alginate impressions lack dimensional stability which leads to reduced accuracy over time. Therefore, the recommendation is immediate leakage, not exceeding a period of 30 minutes (Carneiro, 2015).

Dimensional stability is defined as the material's ability to maintain its dimensional accuracy over a given period. Some impression materials contract during setting as the plaster expands. An accurate model mainly depends on the casting and the compatibility of the impression material with the chosen plaster. It is understood that a short period of time produces more accurate models (Fonte-Boa et al., 2016).

Because alginates are not dimensionally stable, they undergo considerable transformations over time (Goiato et al., 2013). Its acceptance is directly linked to easy handling, low cost, patient comfort and reproducibility, making it possible to perform moldings with good

reproduction of details, if used properly (Rodrigues et al., 2012).

To circumvent the restriction of conventional alginates, in relation to the immediate casting time of suffering dimensional change, new alginates were launched, these materials remain stable for up to five days when impressions obtained with them are correctly stored in a hermetically sealed plastic container, as recommended by the manufacturers (IMBERY et al., 2010).

To evaluate which changes the alginates would undergo and what the reasons for these changes, the general objective of the work is to analyze the dimensional stability of different types of alginates.

II. METODOLOGIA

The present study is applied research in which its approach was quali-quantitative, of an exploratory nature, carried out in study models, dealing with the comparison of materials at different time intervals. The present research was carried out in the dental laboratory of the ITPAC Faculty of Porto Nacional-TO, in the period of the first semester of the year 2022.

02 (two) brands of alginate used in the market were used and 4 models were made. There was a control group that used addition silicone and produced 1 model.

The upper arch of the pronew dummy was selected (Pronew, São Gonçalo, Rio de Janeiro). Subsequently, elements 12, 13, 14, 15, 17, 22, 23, 24, 25 and 27 were removed. Only elements 11, 16 and 26 remained. Soon afterwards, wax 7 (Polidental, São Paulo – Brazil) was introduced in the spaces referring to the dental elements that were removed, so that the region referring to the missing tooth is sealed (Figure 1 - Standard model - Reference points).

Reference points were established:

- Element 11 - Mamelocentral
- Element 16 - Tip of the mesiobuccal cusp
- Element 26 - Tip of the buccal cusp

With the aid of a digital caliper, the distances were measured: central mamel to the tip of the mesiobuccal cusp of element 16, central mamel to the tip of the mesiobuccal cusp of element 26 and tip of the mesiobuccal cusp of element 16 to the tip of the mesiobuccal cusp of element 26. Subsequently, the obtained area was calculated. This area is the reference standard.

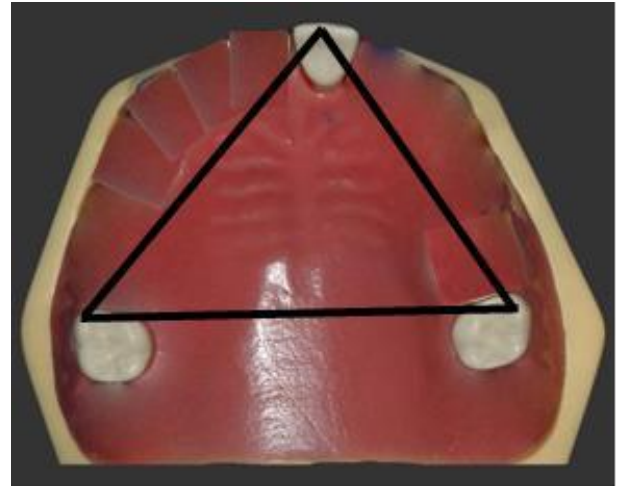


Fig.1 - Standard model and reference points

Source: Survey data (2022).

Then, the moldings were carried out, where the proportion of the irreversible hydrocolloid, as well as the mixing time, was carried out according to the manufacturer's guidelines. The use of powder and water dispensers provided by the manufacturer: for each measuring spoon of powder, one third of the measure of water will be used. To enable the molding of the standard model (pronew mannequin (Pronew, São Gonçalo, Rio de Janeiro), a measure of powder is necessary for a measure of water.

After obtaining a smooth and creamy mass, a Verner type tray number 5 for the upper arch was filled (Tecnodont, Indaiatuba, São Paulo, Brazil), which was positioned on the standard model and, with molding pressure until its final settlement, maintained in that position until its total gelation (four minutes).

After this interval, we removed the tray from the standard model, with a single movement in the vertical direction, to avoid the induction of lateral forces and distortions in the mold. Those molds that were satisfactory, without cracks, with a uniform surface and free of bubbles were selected for disinfection. molds with grooves and bubbles were discarded.

Durone/Dentsplay type IV plaster was mixed under vibration according to the manufacturer's specifications, in a proportion of 20 mL of water to 100 g of powder. A precision scale (Toledo do Brasil Indústrias de Balanças Ltda., SP-Brasil) was used to measure gypsum/water. Then, it was poured into the print and allowed to set in a humidifier. One hour after beginning plaster manipulation, the plaster model was removed from the impression and stored at room temperature.

After the execution of the impressions, we

evaluated the dimensional alteration of each impression.

Reference points were established:

- Element 11 – Mamelocentral;
- Element 16 – Tip of the mesiobuccal cusp;
- Element 26 – Tip of the buccal cusp.

With the aid of a digital caliper, the distances were measured: central mamel to the tip of the mesiobuccal cusp of element 16, central mamel to the tip of the mesiobuccal cusp of element 26 and tip of the mesiobuccal cusp of element 16 to tip of the mesiobuccal cusp of element 26. Subsequently, the obtained area was calculated.

The values of the areas of each model were compared to the area of the standard model (prone mannequin (Pronew, São Gonçalo, Rio de Janeiro).

The data obtained were tabulated and analyzed using parametric tests. Being subjected to analysis of variance (ANOVA) and variables with significant differences were evaluated by Tukey's test at the level of 5% of significance. Data that do not present a normal distribution will be analyzed by non-parametric calculations, using the Kruskal-Wallis test, with the same level of significance. For the application of each test, BioEstat software version 4.0 and Excel and Word software version 2000 were used, for making tables, graphs, and text.

There was a concern and responsibility to make the citations identifying the authors who were part of the study, producing references when mentioned.

III. RESULTS

AVERAGE OF AREAS			
groups	Hidrogun	Jet Plus	Ava gel
1	49 mm	48,9 mm	48,9 mm
2	49 mm	49,1mm	49,3 mm
3	51,1 mm	49,2mm	48,9 mm
4	48,9 mm	49 mm	49,3 mm
5	48,9 mm	49,5 mm	49,1 mm
6	48,9 mm	48,9 mm	48,6 mm
7	49 mm	49,3 mm	49,4 mm
8	48,9 mm	49 mm	48,9 mm
9	49mm	49,1 mm	49,2 mm
10	49,1mm	48,9mm	49,1 mm

According to the results obtained, there was no statistical difference between the groups.

IV. DISCUSSION

Costa et al. (2017) state that alginates are materials that are constantly questioned regarding their clinical indication, since they have low dimensional stability and must be poured immediately after molding. However, in this study, the commercial alginates Hydrogum 5 and Cavex Color Change were dimensionally stable for 120 and 48 hours respectively, while the Jeltrate Plus brand showed increasing dimensional changes after 2 hours. Thus, it is stated that adequate storage conditions (100% relative humidity) are essential to obtain good results. In the present study, there was no difference between the groups.

Alginate is used in dentistry to obtain study models in different specialties in dentistry. The dimensional changes that occur in alginates have been previously studied by other researchers and all authors agree that the amplitude of the dimensional change varies according to the different brands of alginate used (Barbosa et al., 2003 and Carvalho 1999). In the present study, there was no difference between the groups.

The best packaging method in relation to the dimensional stability of the irreversible hydrocolloid is the humidifier box, which can stay up to 45 minutes without undergoing any type of dimensional change according to some studies (Coleman, 1979). The models were all stored in a humidifier and corroborate these studies.

The deformation suffered by the irreversible hydrocolloid is clinically negligible to the point of not compromising the result in the models. According to the present study, the dimensional change is clinically insignificant for the manufacture of study models and wax-up models, but in cases of molding for the purpose of generating prosthetic work, the dimensional change can generate imperfect prostheses (Bergman, 1989).

V. CONCLUSION

It is possible to conclude that the type of alginate did not interfere with the distortion of the standard model.

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