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Evaluation and comparison of the dimensional stability and tear strength of one commercially available autoclavable addition silicone impression material after being subjected to steam autoclave sterilization

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Abstract

Aims: To evaluate the dimensional stability and tear strength of a commercially available PVS impression material following a stem autoclaving.

Settings and design: This study evaluated the effect of autoclaving on elastomeric impressions on dimensional stability and tear strength of PVS impression material (autoclavable) at **3** different time intervals; that is before autoclaving, immediately after autoclaving and 24 hours after autoclaving.

Methods and Material: Autoclavable Affinis PVS (light body) Metallic master model (die) for Dimensional stability, Metallic master model (die) for Tear strength, Autoclave, Thermostat regulator, Metallurgical microscope, Universal testing Machine. A total of 55 specimens were fabricated for the study. The metal die for dimensional stability and for tear strength was fabricated. Measurements were made using a measuring microscope. Distance between the cross lines CD and C’D’ reproduced in the impression were measured and labelled at 3 time intervals, dimensional change and tear strength was calculated.

Statistical analysis used: A student "t" test was used to ascertain statistical difference between the groups.

Result: Results indicate that Affinis PVS (light body) showed no significant change in dimensional stability and tear strength after steam Autoclaving when compared with control group.

Conclusion: The present study indicates an effective and easy method of disinfection of impressions that can be achieved by steam autoclaving, without compromising the dimensional stability and tear strength.

Keywords: Dimensional stability, Tear strength, Autoclavable Elastomeric impression material

Introduction

Impressions are important sources of cross contamination between patients and dental laboratories. As a part of infection control, impressions contaminated with variety of micro-organisms should be cleaned and disinfected or sterilized before being handled in dental laboratory [1]. The items to be treated are classified as critical, semi critical, noncritical [2]. Washing impressions, sometimes, doesn't clear away all the saliva and blood contaminants. Impression disinfection is believed to be one of the simplest methods of control [3, 4]. Autoclaving is considered to be the most effective method of sterilization however, the accuracy of the PVS elastomeric impression material after autoclaving have not been extensively studied. The purpose of this study was to determine the effect of autoclaving on dimensional stability and tear strength of elastomeric impression material.

Materials and Methods

Standardized stainless steel die as per ADA specification number 19 was fabricated as shown in [Figure.1].

Fig.1- Metal master die for dimensional stability

Three lines X, Y and Z were inscribed on the superior surface of the die. The distance between X and Z lines was 5 mm. The width of the lines was 0.020 mm. The die has a stainless steel ring that fits around the borders as a mold for the impression material. The impression material used in this study was polyvinyl siloxane (Affinis) light body and putty viscosities. A total of 40 impressions of the stainless steel die were made as shown in [Figure. 2]

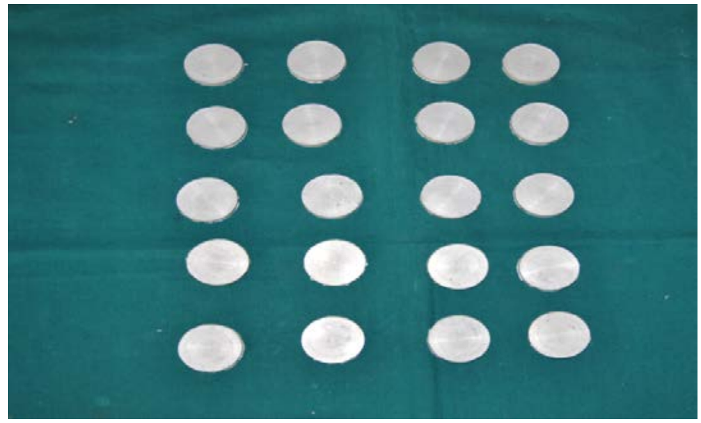


Fig.2 - Samples for dimensional stability

A stainless steel ring to be used as a mould to make an impression was placed on the die. Double mix single impression method was used to make the impressions. Impression material was mixed according to the manufacturer's instructions and was loaded into the mold to make an impression of the die. After loading the mold, impression material was immediately covered by a thin sheet of polyethylene followed by application of sufficient force on a rigid flat metal plate to seat it firmly against the mold. To compensate for polymerization at room temperature rather than at mouth temperature, the impressions were allowed to set for twice the manufacturer's recommended setting time (4 min) as indicated in ADA specification number 19. For tear strength impression material was mixed according to the manufacturer's instructions and was loaded into the metal Die C [Figure.3].

Fig.3 - Metal master die for tear strength

The assembly was immediately transferred to water bath at 32 +_2°C. To compensate for polymerization at room temperature rather than at mouth temperature, the impressions were allowed to set for three minutes after the minimum time recommended by the manufacturer's recommended setting time (5 min) as indicated in ADA specification number 19 for laboratory testing. After setting impression material was removed from the die. The impression was then recovered from the mold and numeric coding system was used to identify the samples. Samples used for tear strength are shown in [Figure.4].

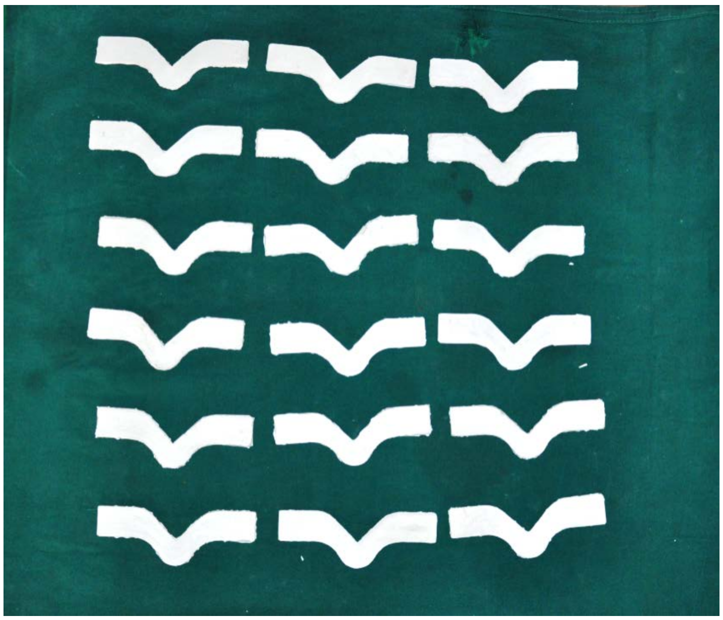


Fig.4 - Samples for tear strength

Samples were packed into autoclavable pouches [Figure. 5,6].

Fig.5 - Sample packed in autoclavable pouch

Fig.6 - Sample packed in autoclavable pouch

Measurements were made using a measuring microscope. The distance between the cross lines CD and CIY, on the ruled stainless steel die was measured to the nearest 0.005 mm and the measurement was recorded as reading A. Distance between the cross lines CD and CIY reproduced in the impression were measured before autoclaving, immediately after

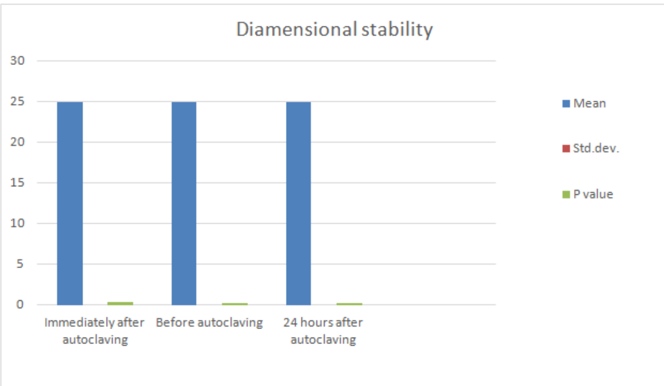
autoclaving and 24 hours after autoclaving and the measurements were recorded as Bl, B2 & B3 respectively. The measurements were made at the edges of the cross lines. The same yard stick was used to make all the measurements. Dimensional change was calculated using the following formula: Dimensional change% (percentage) = (A- B l/2/3) / A x 100. The data obtained was subjected to statistical analysis. A student "t" test was used to ascertain statistical difference between the groups.

Result

The results obtained from this study for dimensional stability are presented in [Table.1, Graph.1]

Study Group	Mean	Std.dev.	P value
Immediately after autoclaving	25.0121	0.03210	0.360
Before autoclaving	25.0144	0.0317	0.250
24 hours after autoclaving	25.0107	0.01375	0.267

Table 1- Statistical data presenting the dimensional stability as compared at three different time intervals.



Graph 1- Dimensional stability of the test samples immediately after autoclaving, before autoclaving and 24hrs after autoclaving.

There is no significant difference in mean dimensional stability between metal die and test specimens before autoclaving and it indicates that the mean difference is - .0118 i.e. contraction but it is not significant since p value > 0.05.

There is no significant difference in mean dimensional stability between metal die and test specimens immediately after autoclaving and it indicates that the mean difference is - .00950 i.e. contraction but it is not significant since p value > 0.05.

There is no significant difference in mean dimensional stability between metal die and test specimens 24 hours after autoclaving and it indicates that the mean difference is - .00439 i.e. contraction but it is not significant since p value > 0.05.

There is no significant difference in mean dimensional stability between test specimens before autoclaving and test specimens immediately after autoclaving and it indicates that the mean difference is - .00854 i.e. contraction but it is not significant since p value > 0.05.

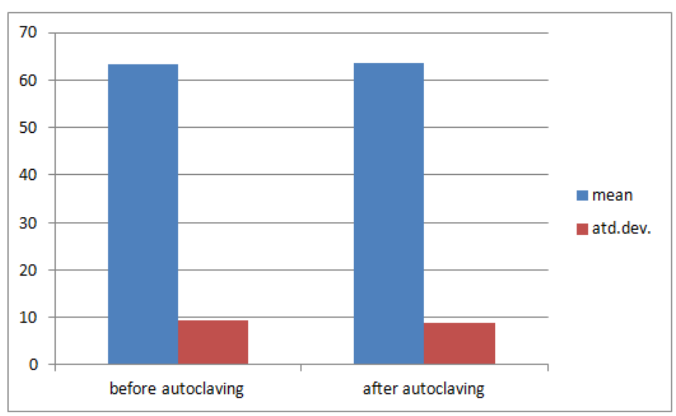
There is no significant difference in mean dimensional stability between test specimens before autoclaving and test specimens 24 hours after autoclaving and it indicates that the mean difference is - .00647 i.e. contraction but it is not significant since p value > 0.05

There is no significant difference in mean dimensional stability between test specimens immediately after autoclaving and test specimens 24 hours after autoclaving and it indicates that the mean difference is - .00659 i.e. contraction but it is not significant since p value > 0.05.

The results obtained from this study for tear strength are presented in [Table.2, Graph.2].

Study Group	Mean	Std.dev.	P value
Before autoclaving	63.3390	9.3206	0.971
After autoclaving	63.4900	8.8225	

Table 2- Statistical data presenting the tear strength as compared at two different time intervals.



Graph 2- Tear Strength of the test samples after autoclaving and before autoclaving.

There is no significant difference in mean tear strength between test specimens before autoclaving and test specimen after autoclaving and it indicates that the mean difference is

- .1510 i.e. contraction but it is not significant since p value > 0.05.

Discussion

The function of dental surgeons as health professionals is to prevent disease in their field or when disease sets in, to treat it [5].

Saliva and blood contaminated impressions are often a source of cross contamination between the clinic and dental laboratory. Explicit communication and observance of an infection control protocol for handling of dental impressions must exist among the office staff as well as between office and dental laboratories. Such an infection control protocol should include guidelines for proper handling and disinfection or sterilization of impressions [6-8].

As part of infection control protocol, it is important to distinguish between sterilization and disinfection; Sterilization results in destruction of all forms of microbial life (viruses and fungi) where as disinfection is destruction of specific pathogenic microorganisms. Sterilization is best achieved by physical methods such as autoclaving which is less time consuming and more reliable than chemical disinfection. Though disinfection of the impressions is routinely followed autoclaving elastomeric impressions is an effective method of sterilizing them.

The transmission of oral pathogens to impressions and subsequently on to casts has been demonstrated [9]. Because, dental impressions present potential hazard to dental office and laboratory personnel, the Centers for Disease Control [10] and American Dental Association (ADA) [11] have published guidelines for infection control that include disinfection of all impressions before they are cast in stone or sent to laboratory.

This study evaluated the effect of autoclaving on elastomeric impressions at 121^{o}C for 15 min on dimensional stability and tear strength of polyvinyl siloxane impression material (autoclavable) [12] at three different time intervals; that is before autoclaving, immediately after autoclaving and 24 hours after autoclaving. Statistically no significant dimensional change was observed between the 3 different time intervals. There was no statistically significant dimensional change between 3 intervals and there was no statistically significant difference between tear strength before autoclaving and tear strength after autoclaving.

Results indicate that Affinis polyvinyl siloxane (light body) showed no significant change in dimensional stability and tear strength after steam Autoclaving when compared with control groups.

Thus the present study indicates an effective and easy method of disinfection of impressions that can be achieved by steam autoclaving which helps in attaining a biologically safe impression, without compromising the dimensional stability and tear strength of material.

Conclusion

Within the limitation of this study, there was no statistically significant dimensional change between 3 time intervals. Autoclaving of the elastomeric impressions (polyvinyl siloxane- light body) can be used to prevent cross contamination between patients and laboratories.

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