

ORIGINAL RESEARCH ARTICLE

A COMPARATIVE EVALUATION OF EASY REMOVAL OF DENTAL CASTS FROM ALGINATE IMPRESSIONS USING DIFFERENT BRANDS OF DENTAL STONE - AN IN VITRO STUDY

ABSTRACT:

Background: The fracture of teeth on removal of dental stone models from an alginate impression is a common phenomenon. Fabrication of a restoration on a fractured prepared tooth leads to inaccuracies in the finished prosthesis. The objective of this study was to comparatively evaluate different brands of dental stone regarding easy removal of dental casts from alginate impressions.

Methodology: Three commercially available brands of dental stone were evaluated using three different tests namely static loading, continuous loading using electronic digital luggage scale, and intermittent loading using a crown remover, and the load applied was recorded.

Results: In all the three tests one of the dental stone brands which contains a modifier required less load to be removed from the alginate impression.

Keywords: Dental stone, alginate impression

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INTRODUCTION

Removal of dental stone models from the alginate impression without fracture of teeth or casts is still a challenge to the dentist and dental technician. Fracture of prepared teeth leads to a distorted restoration and an ill-fitting prosthesis^[1]. Some manufacturers of dental stone claim that with addition of certain modifiers to the dental stone, removal of dental stone from alginate impressions becomes easier. Hence, with this background, a study was conducted to compare the ease of removal of casts prepared with different brands of commercially available dental stone, from alginate impression.

Materials and Methods

Three commercially available brands of dental stone were tested for the ease of removal from alginate impression. The brands were:

- A. Goldstone® from Asian Chemicals, Rajkot, Gujarat
- B. Dentstone® from Pankaj Enterprises, Jammu
- C. Eurostone® from Eurosickenchemtech

The study was conducted in the Department of Prosthodontics, Indira Gandhi Institute of Dental Sciences, Nellikuzhi, Kothamangalam, Kerala. Ethical clearance for the conduct of study was obtained from the ethical committee of the institution.

Methodology:

A U3 size perforated impression tray was specially modified for the test. Three uniform sized metal hooks were welded to the upper surface of the tray. An alginate impression from a master model using tropicalgin was made using this tray. Dental stone was mixed using pre-measured water and pre-weighed stone powder as per manufacturer's guidelines, and poured in the impression placing on a vibrator. A metal hook was placed in the middle of the setting stone cast and it was allowed to set for 2 hours. The tray was then hooked on to an iron rod cemented to the wall. The impression and stone casts were then subjected to 3 different types of tests:-

1. Static loading
2. Continuous loading using a digital electronic

luggage scale

3. Intermittent loading using a crown remover

1. Static loading: The entire apparatus was hung on to the iron rod using the three metal hooks on the tray. A load of 5 kilogram was applied initially for a period of 5 seconds. The load was gradually increased till the cast was dislodged from the impression. The load required to dislodge the impression was recorded in Table 1. Twenty such samples were tested.

Fig1: Figure showing static loading test



2. Continuous load by digital electronic luggage scale.

Using an electronic luggage scale (Camry, ISO 9001:2008, Model EL10) the stone cast was pulled down from the impression and the load was recorded on the electronic digital scale. The values were recorded in Table 2. Twenty such samples were tested.

Fig 2: Figure showing load application by digital electronic luggage scale



3. Intermittent loading using crown remover

The similar type of samples and apparatus were subjected to a load applied by intermittent loading using a crown remover. The crown remover used was of the pneumatic type (Automatic crown remover, marketed by Ashoo sons, Delhi). The number of strokes for removal of cast from the impression were counted and recorded in Table 3. Twenty such samples were tested.

Fig 3: Figure showing intermittent loading using crown remover



Statistical Analysis:

The results were summarised and tabulated in terms of mean \pm standard deviation in Table 4. Inferential analysis for evaluating significant differences (if any) between the various products in this study was done using one way Analysis of Variance followed by Tukey's post hoc test for pair wise comparison. The analysis was done using statistical package for social sciences (SPSS) version 17.0 for windows. The level of significance was set for $\alpha=0.05$.

RESULTS

20 samples were tested for each brand of dental stone. The results obtained were tabulated as Table 1, 2, 3 and 4:

Table 1: Table showing load applied in static loading test

Sample	Eurostone (kilogram)	Goldstone (kilogram)	Dentstone (kilogram)
1	20	26	27
2	19	27	27
3	20	25	28
4	20	26	28
5	20	26	26
6	19	26	26
7	21	26	27
8	19	26	27
9	21	27	27
10	20	25	27
11	20	28	27
12	20	24	27
13	21	25	27
14	18	25	27
15	20	25	27
16	20	25	27
17	20	25	27
18	20	28	27
19	21	24	28
20	21	24	26
Average	20	26.95	27

Table 1 presents the load applied in the static loading test for all the three different brands of dental stone. Eurostone needed an average of only 20 kilogram, Goldstone needed an average of 26.95 kilogram and Dentstone an average of 27 kilogram to dislodge from the alginate impression.

Table 2: Table showing load applied by digital electronic luggage scale

Sample	Eurostone (kilogram)	Goldstone (kilogram)	Dentstone (kilogram)
1	24	30	32
2	24	31	33
3	24	32	31
4	24	30	30
5	24	29	31
6	23	29	31
7	24	30	32
8	25	29	32
9	24	30	33
10	24	29	33
11	23	31	31
12	25	29	32
13	25	31	31
14	23	30	32
15	24	30	31
16	24	31	32
17	24	31	31
18	24	30	32
19	24	29	32
20	24	30	32
Average	24	30.05	31.7

Table 2 presents the load applied by a digital electronic luggage scale to remove the dental stone cast from the alginate impression. Eurostone showed an average of 24 kilograms, Goldstone an average of 30.05 kilograms and Dentstone an average of 31.7kilogram.

Table 3: Table showing number of strokes in test using crown remover

Sample	Eurostone (kilogram)	Goldstone (kilogram)	Dentstone (kilogram)
1	22	28	29
2	22	28	29
3	21	27	28
4	23	29	30
5	22	28	28
6	22	29	30
7	23	28	29
8	21	27	29
9	22	28	29
10	22	27	29
11	21	28	30
12	23	29	29
13	20	28	29
14	21	29	29
15	22	27	30
16	22	28	28
17	22	28	28
18	20	28	28
19	23	28	28
20	20	28	28
Average	21.7	28	30.25

Table 3 presents the number of strokes applied by the crown remover to dislodge the cast from the impression. Eurostone showed an average of only 21 strokes, Goldstone an average of 28 strokes and Dentstone an average of 30 strokes.

Table 4: Table showing summarised results

Test	Eurostone (E)	Goldstone (A)	Dentstone (B)	ANOVA test	Tukey's post hoc test
Static loading(Kg)	20.5±2.140	25.65±1.182	27±0.562	F=112.196 P<0.01	B>A>E
Electronic luggage scale(kg)	24±0.562	30.05±0.887	31.7±0.801	F=112.196 P<0.01	B>A>E
Number of strokes	21.7±0.979	28.0±0.649	28.85±0.745	F=473.242 P<0.01	B>A>E

Both the Anova test and Tukey's post hoc test reveal that a statistically significant difference existed for all the three different brands of dental stone in the various tests conducted between Eurostone, Goldstone and Dentstone.

The pair wise comparison revealed that Eurostone needed the least force(kg) and crown remover strokes for removal of cast from alginate impression than the other two brands. Goldstone needed the second least force and strokes and, Dentstone needed the most force and strokes for removal of cast from alginate impression.

DISCUSSION

The objective of this study was to compare the three commercially available dental stones namely Goldstone, Dentstone, and Eurostone in relation to the ease of removal of set dental stone from alginate impression material.

Eurostone is a commercially available brand of dental stone that claims to have modifiers that ease the removal of set stone from the impression. Hence Eurostone was included in the study.

The results of this study show that casts poured using Eurostone are more easily detachable from the alginate impression than casts poured from the other two brands of commercially available dental stone. The detachability is probably contributed by the modifier in Eurostone, which manufacturers claim acts as a lining or separating media on the cast surface.

Although studies have been done on other aspects of teeth fracture on casts, no study has been reported in the available electronic literature evaluating the ease of removal of dental stone casts from alginate impressions.

Von Krammer. R studied the methods of avoidance of cast breakage during removal from impression. Methods such as sectioning the impression tray were found to be effective^[1]. But such methods are time consuming and expensive. Likeman P and Paolinelis G investigated the accuracy of refixing broken teeth to stone casts using a Triclone contact

scanner. They found that fractured teeth were significantly displaced from their original position, thereby affecting the accuracy of the fabricated prosthesis.^[2]

The present study was conducted using alginate impression material. Galindo D and Hageman ME studied cast breakage during separation from elastomeric impressions. They felt the rigidity of the impression material is responsible for the fracture^[3]. Hence further studies are recommended using other impression materials like elastomeric impression materials.

The laboratory significance of this study is that the dental stone with such modifiers can be used without fear of cast fracture during separation from alginate impression material, thereby enabling fabrication of a successful prosthesis.

CONCLUSION

Eurostone dental stone was found to be more easily detachable from the alginate impression material than Goldstone and Dentstone. Goldstone was found to be more easily detachable from alginate impression than Dentstone dental stone.

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