

Evaluation of Wear of Human Enamel by the Newly Developed Porcelain Compared with Commonly used Traditional Feldspathic Porcelain under Different Loads in Acetic Acid- An Invitro Study

J.Baranikrishnan¹, K.Vinayagavel², C.Sabarigirinathan³, P.Rupkumar⁴, S.Elavarasan⁵, VinayBharti⁶, G.Sriramaprabu⁷, J.Gandhimathy⁸, N.Sangeethameena⁹

1- Associate Professor, Government Vellore Medical college, Tamilnadu. 2- Professor, Department of Prosthodontics, Tamilnadu Government Dental College and Hospital Chennai. 3- Professor and HOD, Department of Prosthodontics, Tamilnadu Government Dental College and Hospital Chennai. 4,7- Associate professor, Department of Prosthodontics, Tamilnadu Government Dental College and Hospital Chennai. 8- Senior Assistant Professor, Department of Prosthodontics, Tamilnadu Government Dental College and Hospital Chennai. 5,6,9- PG students, Department of Prosthodontics, Tamilnadu Government Dental College and Hospital Chennai.

Correspondence to:
Dr.K.Vinayagavel, Professor, Tamilnadu Govt Dental College and Hospital, Chennai-3.
Contact Us: www.ijohmr.com

ABSTRACT

Ceramic are used in dentistry for the past 10 decades. Dental porcelains are classified according to their firing temperature, and their compositions. The strength of the enamel porcelain is assessed by its wear strength. Enamel porcelain quality is can be improved by the glazing. Evaluation of wear of human enamel by recently developed porcelain compared with commonly used traditional feldspathic porcelain under different loads in acetic acid is determined.

KEYWORDS: Porcelain, glaze, Wear of enamel, Types of ceramics, Acetic acid, Micrometer

INTRODUCTION

Dental porcelains is an ideal material for the replacement of lost natural tooth. All dental ceramic materials are to be fired to get the adequate strength. Porcelain used as a restorative material should be well glazed because unglazed porcelain is prone to plaque accumulation.¹ In this study, Evaluation of wear of human enamel by the newly developed porcelain compared with commonly used traditional feldspathic porcelain under different loads in acetic acid is determined.

Aim of the study: Evaluation of wear of human enamel by the newly developed porcelain compared with commonly used traditional porcelain under different loads in acetic acid is determined.

MARKERS FOR ORTHODONTIC TOOTH MOVEMENT

In this study the materials used are Vita VMK 95, Ivoclar design porcelain, Ivoclar classic all these are feldspathic porcelain, Freshly extracted teeth samples, Metal dies, Vacumat ceramic furnace, Reciprocating sliding wear test machine and Acetic acid, Micrometer.



Fig 1: Metal Die



Fig 2: Tooth Sample

How to cite this article:

Baranikrishnan J, Vinayagavel K, Sabarigirinathan C, Rupkumar P, Elavarasan S, Bharti V, Sriramaprabu G, Gandhimathy J, Sangeethameena N. Evaluation of Wear of Human Enamel by the Newly Developed Porcelain Compared with Commonly used Traditional Feldspathic Porcelain under Different Loads in Acetic Acid- An Invitro Study. *Int J Oral Health Med Res* 2015;2(3):18-20.

Preparation of test samples: Ten testing samples of each dental ceramics, with the use of metal dies and converted in to the rectangular shaped working specimen. 30 mm length, 10mm width and 3mm thickness).² Each ceramic material firing and glazing were carried out in accordance a with manufactures recommendation. Finally the three ceramic materials were provided in the form of rectangular shape with 24mm length 8mm width and 2.5mm thickness.

Preparation of tooth specimen: The enamel of the natural tooth portion were taken from the recently extracted molar tooth and sectioned into buccal and lingual fragments. The specimens were attached to the 10mm diameter of 1/2 inch length aluminium cylinder with use of die stone.³

Wear Testing Machine:The testing samples were placed in the test rig and then the reciprocating motion between the tooth and the test specimens were obtained by mechanical link. The test rig consists of lowering moving specimen holder and upper stationary counter specimen holder, in which test specimens are fixed. For measuring displacement of fretting specimen a laser optical displacement sensor is used. The frictional forces, slip amplitude and frequency are continuously recorded using computer controlled data system.

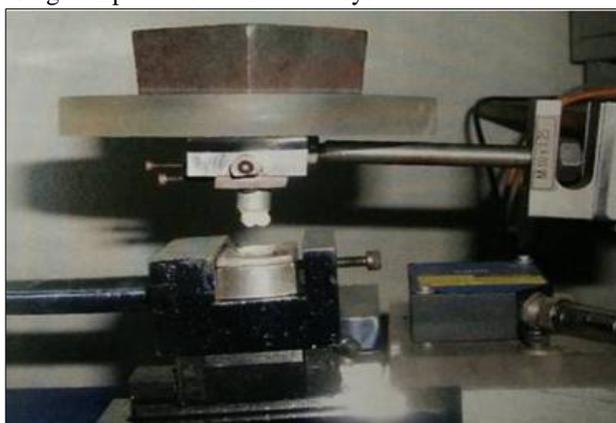


Fig 3: Specimen placed in Test Machine

Experimental procedure and wear measurement: Before test both the tooth and specimens were ultrasonically cleaned in distilled water and dried. Tests were carried out at a constant displacement of 100 micrometer during the studies. Specimens are mounted in, the specimen holder. The test samples were mounted in the acetic acid medium; Tests were conducted at different loads ranging from 3kg to 5kg. The duration of the test was 2 hours, and the frequency of motion is 10 hertz. The amount of wear was determined by measuring the height loss of the tooth. The initial and final tooth dimensions were measure using the 1 micron accuracy micrometer. At least five readings were taken before and after the test and an average value was considered.

Statistical analysis: Tooth wear was tested for three groups and five samples were selected for each group and a total number of fifteen samples were prepared and used. The amount of wear calculated by measuring the height

of tooth loss. At least five reading were taken before and after the test and average value was considered.

RESULTS

Table 1 Shows that the test was carried out in acetic acid and tooth wear measured under 3,4,5 kg load opposing three different groups of ceramic samples.

When 3 kg load applied Ivoclar classis (10.4 μm) ceramic material exhibited greater wear than Ivoclar design (6.8 μm) but lower than vita ceramic material (13.2 μm). Vita ceramic material exhibited greater wear than ivoclar classic and ivoclar design. Lesser wear obtained in Ivoclar design. When 4kg load applied Ivoclar classic (13.6.μm) ceramic material exhibited greater wear than Ivoclar design (10.0 μm) but lower than vita ceramic material (16.8.μm). Vita ceramic material exhibited greater than ivoclar classic and ivoclar design. Least wear obtained in ivoclar design. When 5kg load applied Ivoclar classic (17.2μm) ceramic material exhibited greater wear than Ivoclar design (13.7 μm) but lower than vita ceramic material (20.6 μm). Vita ceramic material exhibited greater wear than ivoclar classic and ivoclar design. Least wear exhibited in ivoclar design.

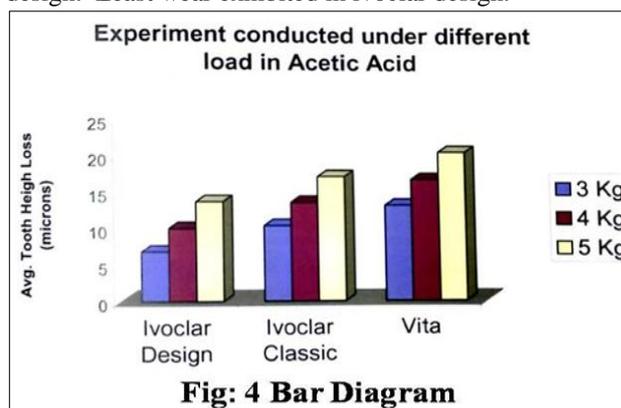


Fig: 4 Bar Diagram

Normal Load (KG)	Ivoclar design(μm) enamel porcelain	Ivoclar class(μm) enamel porcelain	Vita(μm) enamel porcelain
3	6.8	10.4	13.2
4	10	13.6	16.8
5	13.7	17.2	20.6

Table;1. Experiment conducted under different loads in acetic acid.

DISCUSSION

This study investigated in vitro to access the wear of human enamel opposing three dental ceramics using wear machine that was developed in an attempt to simulate the correct process that occur in the mouth. Tests were conducted at different normal loads from 3,4,5 kg at acetic acid, The duration of the tests were 2 hours and the frequency of motion is 10 Hz.⁴

The development of wear machine is an attempt to simulate the clinical masticatory cycle and oral environment. The load chosen in this study was based on

the required weight of activate the compression springs on each individual specimen. Here the wear may be taken place due to wear appears to be more related to roughness and fracture resistance the strict hardness values.⁵ In this study amount of wear was determined by height loss of the tooth and the tooth wear in the enamel specimen were recorded by means of a micrometer. Tooth specimen exhibits higher wear rate lesser than 5kg load than 3 kg load and all the tooth specimens exhibited significantly higher wear rates under acetic acid.

SUMMARY

Ceramics in modern dentistry have been used since the 18th century. But it dissolves in acid medium. The surface is less soluble in acid than the deeper enamel. The clinical enamel wear occurs due to para-function, saliva composition, environmental factors, age, pathoses, enamel composition and acidity^[6]. In an attempt to minimize the wear damage when opposing natural teeth, new low fusing ceramic materials have been developed. The manufactures claim that these ceramics are wearing friendly because of their low hardness, lower concentrations of crystal phase and smaller crystal sizes.

The main purpose of this study is to analyze wear of human enamel by these newly porcelain with commonly used traditional feldspathic porcelain under different loads.

Tests were conducted at different normal loads ranging from 3 kg to 5 kg at acetic acid. The reciprocating sliding wear test machine was chosen for the simplicity of operation. In vitro data presented in this study is

determining the wear behaviour of these three different types of ceramic material and in explaining the mechanisms.

CONCLUSION

As far as this study the wear rates of enamel and three different ceramic materials tested varied significantly in acetic acid with varying load. Ivoclar classic ceramic material exhibited greater wear than Ivoclar design but lower than vita. Vita ceramic material exhibited greater wear than ivoclar classic and ivoclar design. Least wear exhibited in ivoclar design.

REFERENCES

1. Ahlgren J, Owall B. Muscular activity and chewing force a polygraphic study of human mandibular movements Arch Oral Bior 1970;15:271-80.
2. Al-Hiyasat AS, Saunders WP, Sharkey SW, Smith G. Three body wear of human enamel against dental ceramics. J dent Res 1998;77:779.
3. Brackett SE, Leary Turner KA, Jordan RD, An evaluation of porcelain strength and the effect of surface treatment. J prosthet. Dent. 1989;61:446-51.
4. Burwell J. Survey of possible wear mechanism ear 1957;119-41.
5. Craig RG, Powers JM. Wear of dental tissues and materials. Int Dent J 1976;26:121-33.
6. Celland NL, Agarwala V, Knobloch LA, Seighi, RR, wear of enamel opposing low fusing and conventional ceramic restorative materials; JProsthodont 2001;10:8-15.

Source of Support: Nil
Conflict of Interest: Nil