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Evaluation of Wear of Human Enamel by the Newly Developed Porcelain with Commonly Used Traditional Feldspathiic Porcelain under Different Loads

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Abstract: *Ceramics is an ideal material for the replacement of lost tooth. All ceramic materials are either to be dried or fired to get the desired strength. Porcelain used as a restorative material should be well glazed because unglazed porcelain is prone to plaque accumulation. Evaluation of wear of human enamel by the newly developed porcelain compared with commonly used traditional feldspathic porcelain under different loads.*

Key words*: Porcelain, glaze, Vacumat ceramic furnace, Reciprocating sliding wear test machine.*

I. Introduction

Dental porcelain is available as a restorative material for over 150 years. Ceramics is an ideal material for the replacement of lost tooth. All ceramic materials are either to be dried or fired to get the desired strength [1]. Porcelain used as a restorative material should be well glazed because unglazed porcelain is prone to plaque accumulation. In this study, Evaluation of wear of human enamel by the newly developed porcelain with commonly used traditional feldspathic porcelain under different loads was done [2].

Aim of the study:

Evaluation of wear of human enamel by the newly developed porcelain with commonly used traditional feldspathic porcelain under different loads.

II. Materials

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

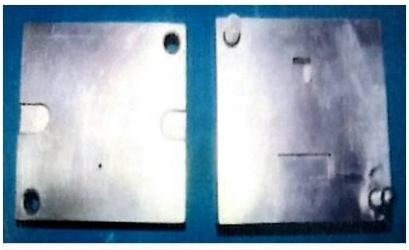

Fig: 1 Metal Die

Fig: 2 Metal Die With Ceramic Sample

Preparation of test samples:

Ten samples of each ceramic material were formed into the rectangular shape with use of metal die(30 mm length, 10mm width and 3mm thickness) 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 were obtained from the recently extracted human molars and sectioned into buccal and lingual fragments. The specimens were attached to the 10mm diameter of ½ inch length aluminium cylinder with use of die stone.

Wear Testing Machine:

The specimens are mounted in the test rig, the reciprocating motion between the tooth and the test sample is achieved 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 monitored and recorded using computer controlled data acquisition system.

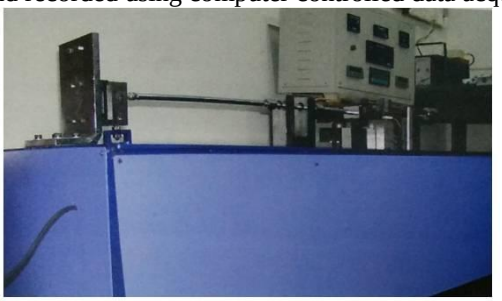

Fig: 4 Reciprocating Sliding Wear Test Machine

Experimental procedure and wear measurement:

Before test both the tooth and sample were ultrasonically cleaned in distilled water and dried. Tests were carried out at a constant displacement of 100 um during the studies. Specimens are mounted in the specimen holder. Tests were also conducted in the air. 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 [3]. The initial and final tooth dimensions were measure using the 1 micron accuracy micrometer. A t 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 of samples and five samples were selected for each group and a total number of fifteen samples were prepared and used. The amount of wear was determined by measuring the height loos of the tooth. At least five reading were taken before and after the test and average value was considered. The tooth wear in the specimen were recorded by means of micrometer. The basic data of results of tooth wear were shown in table I. The test was carried out in air and tooth wear was measured under 3kg, 4kg, and 5kg load opposing three different groups of ceramic samples.

When 3 kg load applied Ivoclar classis (2.4 µm) ceramic material exhibited greater wear than Ivoclar design (1.2 µm) but lower than vita ceramic material (13.2.µm). Vita ceramic material exhibited greater wear than ivoclar classic and ivoclar design. Least wear exhibited 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 exhibited in ivoclar design. When 5kg load applied Ivoclar classic (17.2.µm) ceramic material exhibited greater wear than Ivoclar design (13.70.µm) but lower than vita ceramic material (20.6.µm). Vita ceramic material exhibited greater than ivoclar classic and ivoclar design. Least wear exhibited in ivoclar design [4].

Experiment conducted under different loads in AIR.

Normal Load (KG)	Ivoclar design(µm) enamel porcelain	Ivoclar class(µm) enamel porcelain	Vita(µm) enamel porcelain
3	1.2	2.4	3
4	2.9	5.0	6.2
5	4.8	7.8	9.7

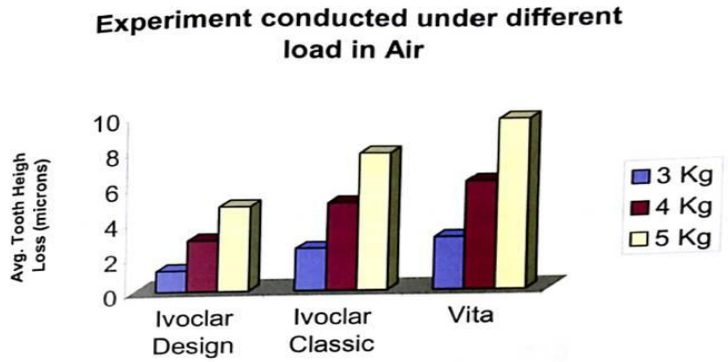

Fig: 5 Bar Diagram

III. Discussion

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

The development of wear machine is an attempt to simulate the clinical mastigatory 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 carrier. Here the wear may be taken place due to wear appears to be more related to roughness and fracture resistance the strict hardness values. 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 micrometer. Tooth specimen exhibits significantly higher wear rate less than 5kg load than 3 kg load and all the tooth specimens exhibited significantly higher wear rates under acetic acid than distilled water and air.

IV. Summary And Conclusion

Ceramics in modern dentistry have been used since the 18the century. But it dissolves in acid medium. The surface is less soluble in acid than the deeper enamel. The clinical enamel wear taken place due to para function, saliva composition, environmental factors, age, pathoses, enamel composition and acidity [6],[7]. 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 wear friendly because of their low hardness, lower that these ceramics are wear 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 3kg to 5kg 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.In experiment conducted under different loads in air. Ivoclar classic ceramic material exhibited greater wear than ivoclar design but lower than vita ceramic material. Least wear exhibited in ivoclar design.

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