International Journal Dental and Medical Sciences Research
Volume 5, Issue 6, Nov-Dec 2023 pp 202-205 www.ijdmsrjournal.com ISSN: 2582-6018

In Vitro Evaluation of Color and Contrast ratio of Different Lithium Disilicate Ceramics thesis

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Date of Submission: 05-12-2023 Date of Acceptance: 15-12-2023

INTRODUCTION

Over the last 20 years, lithium disilicate based glass ceramics have become indispensable materials in the field of esthetic and restorative dentistry. The combination of esthetics, high strength,chemical, and processing properties allow them to be used over awide spectrum of indications and thus make them very popular among clinicians and dental technicians.[1]However, recently novel Lithium disilicate ceramicshavebeen introduced to the marketusing various methods of fabrication.

Lithium disilicate ceramics belong to the category of glassmatrix ceramics that contain asilicon dioxide matrix inwhich additional crystals are embedded.[2] The glass matrix alone, as found in purely glassbased systems, does not offer enough resistanceagainst defects and possibly resulting crack propagation, thus suchsystems exhibit lower mechanical properties. However, through thedispersion of crystals (e.g., alumina, zirconia,leucite, or lithium disilicate) into the glass matrix the crack progression can be slowed downor even inhibited.[3]

Lithium disilicate ceramicsare based on the binary phases of quartz and lithium dioxide(SiO_2-Li_2O).Additionally, phosphorous pentoxide (P_2O_5) is added as a nucleation agent which promotes the volume nucleation of the lithiumsilicate phase. Other raw powders, such as aluminum oxide (Al_2O_3),
potassium oxide (K_2O), aluminum metaphosphate ($Al[PO_3]_3$), zirco-nium dioxide (ZrO_2), zinc oxide (ZnO), Calcium oxide (CaO), vanadium pentoxide (V_2O_5), or cerium dioxide (CeO_2) are added to the base glass mix to improve the chemical durability as well as the mechanical andopticalproperties.[4]

Esthetic outcomes of a ceramic restoration depend on its translucency and color properties.[5,6] In addition, color stability is animportant parameter for a long-lasting restoration[7]as color changemay affect the quality of a restoration.[8]

Lithium disilicate ceramicsmaterialsare available in a largevariety of shades and translucencies. They include some if not all shades of the VITA shades plus several bleach shades. The shade ofthe ingots or blocks is usually controlled by adding metal oxides as pigments (e.g., vanadium pentoxide, cerium dioxide) to the glass matrix during the manufacturing process.[4] However, since the resulting restorations are usually monochromatic,they must be often stained or characterized by the technician or dentist. This can be either done together with or after the crystallization step by applying compatible glass ceramic stains that contain fluoroapatite crystals on the external surface of therestoration.[9]

The translucency is controlled by the nano-structure and size of the crystals.[10] Some systems offer up to four levels of translucency: high translucency, medium translucency, low translucency, and highopacity. Foraspecific CADCAM blocks, different translucencies canbe obtained from the same block. The translucency of these Lithium disilicate ceramic blocks is temperature dependent and can be modified by increasing the crystallizationtemperature. New Lithium disilicate ceramic CAD-CAM blocks revealed significant differences intheir overall translucency, chroma, and value within the same category. [11]

Selection of the translucency matters since the thinner the restoration is the more the underlying substrate[12] and also the cement can have an influence on thefinal optical and esthetic result.[13]Darker cement shades cause more changesin ceramic translucency, chroma, and shade in high translucency Lithium disilicate ceramics compared to low translucency material.[14]The translucency will alsoinfluence the light transmission and subsequently the degree of conversion of resin cements used for bonding of the restoration.[15]

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Artificial accelerated aging with either ultraviolet light or temperature and humidity variations has been used to assess the color stability of various dental materials by simulating clinical conditions.[16] Thermal cycling is a popular in vitro procedure that simulates the oral environment by causing artificial accelerated aging. This methodincludes standardized thermal variations in a humid environment with deionized water, which simulates the thermal variations in the oral cavity.[17]

Thermalcycling simulates the behavior of the restorative material in the oral environment. Artificial aging by thermal cycling and exposure to staining solutions (coffee thermocycling) is demonstrated to have a significant effect on the optical properties of ceramic materials , thereby affecting the esthetic outcome.[18] Color changes from aging are usually associated with the extrinsic staining agents. The longevity and esthetic appearance of tooth-colored restorations depends on the material's susceptibility to staining.[19]

The color of both teeth and esthetic restorationscan be evaluated with spectrophotometers or colorimeters. Spectrophotometers measure the wavelength that is reflected or transmitted from one object at atime, without being affected by the subjective interferences of the color,[20] whereas colorimetersprovide an overall measurement of the light absorbed.

TheCommission Internationale de l'Eclairage L*a*b*(CIELab)system measures chromaticity and defines thecolor of an object in a uniform 3-dimensional space. Color difference is calculatedthrough differences in thecolor coordinates L*, a*, and b* (L* corresponds to lightness;a* corresponds to redness;b* corresponds to yellowness).[21]

Aim of the study

This **In-vitro** study will evaluatecolor and contrast ratioof different manufacturing (pressableandmachinable) lithium disilicate ceramics before and after aging condition .

Materials and Methods

Materials:

1) PressableLithium Disilicate Ceramics.
2) Machinable Lithium Disilicate Ceramics.

Methods:

A total of 64discshapedspeciments of lithium disilicateceramicswill be fabricated and devidedinto 2 main groups according to manufacturing techniques and each main group will bedevidedinto 4 subgroups (n = 8) according to different brands .

Group (1) : Pressable Lithium Disilicate Ceramics (n = 32) will be devidedinto 4 subgroups (A,B,C,D)(n = 8)

Subgroup (A)lithiumdisilicate brand (A) (control group)
Subgroup (B) lithiumdisilicate brand (B)
Subgroup (C) lithiumdisilicate brand (C)
Subgroup (D) lithiumdisilicate brand (D)

Group (2) : Machinable Lithium Disilicate Ceramics (n = 32)
will be devidedinto 4 subgroups (E,F,G,H) (n = 8)

Subgroup (E)lithiumdisilicate brand (E) (control group)
Subgroup (F) lithiumdisilicate brand (F)
Subgroup (G) lithiumdisilicate brand (G)
Subgroup (H) lithiumdisilicate brand (H)

Each Group will be immersed into coffeethermocycling.Color coordinate measurements will be before and after coffee thermo-cycling. Color differences(ΔE_{00}) and Contrast ratio(CR) will be calculated .

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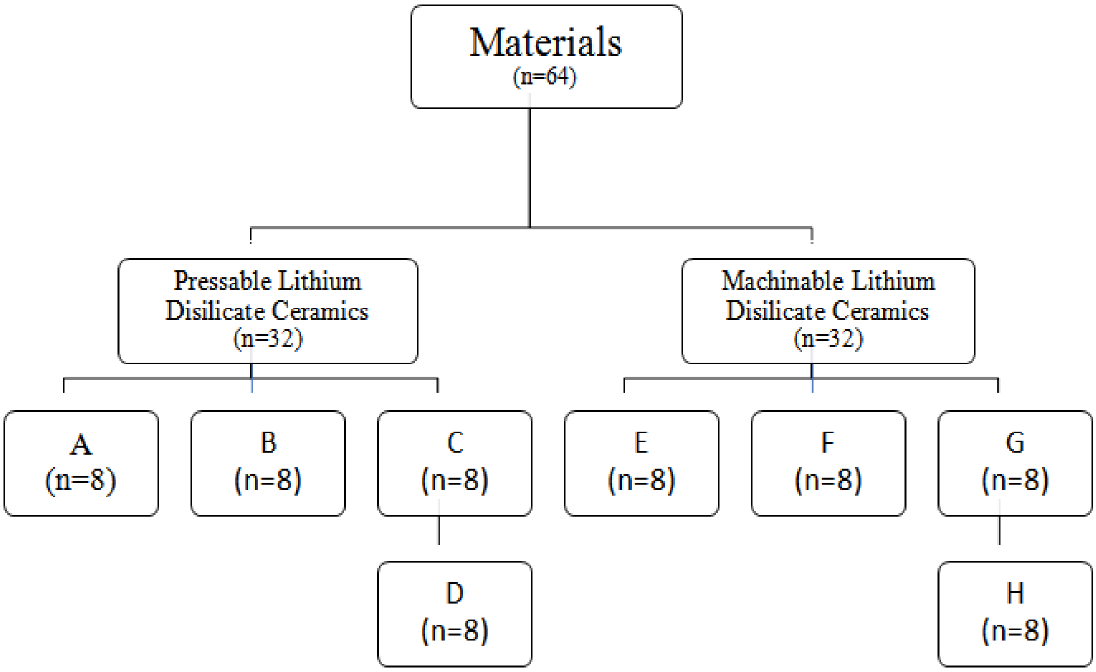

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