1. INTRODUCTION

The appearance of natural teeth is best mimicked by ceramic materials. In recent years the popularity of all-ceramic dental restorations has increased due to their high esthetic qualities and metal-free structure. Significant developments in all-ceramic materials have created wonderful opportunities for the fabrication of lifelike restorations that provide reliable, long-term results[1].

However, all-ceramic dental materials are inherently fragile in tension, affected by micro cracking, flaws, and defects that may be introduced during thermal treatment or fabrication procedures. The fabrication process precision, and skills of individual dental technicians, may affect the reliability and clinical performance of all-ceramic restorations[1].

Mechanical properties such as strength and optical properties such as color and translucency are the first parameters assessed to understand the clinical potential and limits of dental ceramics.

Natural glaze is a glazed ceramic layer formed on the surface of porcelain, containing a glass phase when the porcelain is heated to the temperature of glaze for the time specified by the manufacturers. This layer may deteriorate with clinical modifications to the final restoration, leading to a coarse surface that resembles a pre-treated surface[2].

Polishing has been shown to improve structural resistance to oral conditions and ensure visual properties of restoration. The transparency and strength of the slab and the veneer system can be seen in the ceramic system with natural enamel that has a transparency failure[3].

INTRODUCTION

The translucency of dental restorative material is usually determined by Contrast ratio (CR) or Transparency Parameters (TP). Translucency of dental ceramics materials is important for the esthetic quality of the dental restorations[4].

All ceramic crowns allow for greater transfer of light through the crown and can mimic the appearance of natural teeth in terms of surface texture and trans-electivity. Differences in the transparency of the basic materials in the restoration process may affect final results[5].

The objectives of this study were to determine the effects of different surface finishing protocols on the surface roughness and ultra-translucency of two different ceramic materials.

2. REVIEW OF LITERATURE

Dental ceramics are materials that are part of systems designed to produce dental prostheses, which in turn are used to replace missing or damaged dental structures. The literature on this subject defines ceramics as inorganic and non-metallic materials made by man by heating raw metals at high temperatures.

Ceramic is fragile, which means it exhibit high compressive strength but low tensile strength and can break under very low pressure (0.1%)[6]. As restorative materials, dental ceramics have defects mostly because they cannot afford the labor force that is found in the oral cavity. Thus, they initially found limited use in the spleen and stump areas, although the further development of these materials enabled them to be used as partial long-term fixed replacements and synthetic implants for dental implants. All ceramic teeth display low fracture hardness as compared to other dental materials, such as metals[6].

Ceramics are classified by microscopic structure (i.e., crystalline type, quantity, and glass composition). They can also be classified according to processing technology (energy - liquid, compressed or treated).

1. Microstructural Classification

Ceramics can be defined according to the nature of their composition of glass-to-crystalline ratio. Infinite fluctuations could be present in the fine structures of materials, but they can be divided into four basic structural categories, with a few subsets:

- Composition category (1): glass-based systems (basically silica)
- Composition category (2): glass-based systems (basically silica with fillers), crystalline (leucite or lithium disilicate),
- Composition category (3): crystalline- based systems with glass fillers (basically alumina)
- Composition category (4): polycrystalline solids (zirconia and alumina).

a. Zirconia based ceramics

The modern era, which faces an ever-increasing array of ceramic materials for industrial or biomedical use, can be described as a "ceramic age". Ceramic materials have been developed specifically for medical use and bio-ceramics for teeth. Over the past decade, Zirconia has promoted the rapid development of free metal dental care, which can provide high biological compatibility, improved aesthetics and improved strength.

The name "Zirconium" comes from the Arabic word "Zarqun" which means "golden color" which comes in turn from the Persian words that he visited (gold) and (color).

Zirconium dioxide (ZrO_2) was accidentally discovered by a German chemist named Martin Heinrich Klapproth in 1789 while working with some procedures that included heating some of the gems. Later, zirconium dioxide was used as a rare substance for a long time. In the late 1960s progress in research, zirconium use was improved as biomaterials. The first use of zirconium oxide (ZrO_2) for medical purposes was in 1969 in bone as a new replacement of hip rather than titanium or synthetic alumina[7].

Zirconium (Zr) is a transitional metal element, atomic number 40, atomic weight 91.22, density of 6.49 g / cm, melting point 2,128 K and boiling (4,682 K) with exceptional resistance to corrosion. Pure zirconium is found in crystalline form as a white metal, rubber and in amorphous form as a black-blue powder. Zirconium is the 18th most abundant element in the earth's crust, yet it is not pure in nature but only in conjunction with ZrO_2 $XSiO_2$ or free oxide (ZrO_2). Zirconium dioxide (ZrO_2) is a white crystalline oxide of zirconium[8].

The zirconium oxide crystals can be classified into three crystalline phases: the cubic phase (C) in the form of a straight prism with a square side, and the tetragonal phase (T) in the form of a straight prism with rectangular sides and a monoclonal phase. (M) In a distorted shape with parallel sides.

The cubic phase is fixed at 2370 ° C and with moderate mechanical properties; the quadruple phase is fixed between 1170 ° C and 2370 ° C with improved mechanical properties. The monolayer phase is stable at room temperature up to 1170 ° C with minimal mechanical properties and can contribute In reducing the cohesion of ceramic particles[9].

These transformations are martensitic, characterized by diffusion lessens, which means the need of changing the temperature rather than at a specific temperature, involving the form of distortion. This range of transformation is limited by martensitic onset (MS) and martensitic termination temperatures. The changes in the cooling volume associated with these transformations are very important and objective, resulting in pure material that is not suitable for any application requiring a solid structure. This change is about 2.31% in the case of C → T transformation and about 4.5% on cooling from T to M[10].

Phase transformation

Zirconia can be found in ambient pressure in a form of three crystalline forms depending on the temperature. At room temperature and when heating up to 1170 ° C, be monocular. At a temperature ranging from 1170 and 2370 ° C, it is quadrilateral and above 2370 ° C until its fusion point is a cube.

In the cooling process, the transition from quadruple (t) to monochrome (m) is characterized by a large increase in volume (about 4.5%), sufficient to lead to catastrophic failure, which is sufficient to lead to catastrophic failure. This shift starts at 950 ° C and can be reversed[11].

Garvie et al. (1972)[9]**,** explained the best way to use zirconia phase conversion to improve the mechanical strength and rigidity of this type of ceramic. They have stated that the quaternary tetrahedron, which is accurately distributed within the cubic matrix, can be converted to the monoclonal phase when the constraint imposed by the matrix is mitigated by a crack that is spread within the matrix. The pressures resulting from phase shift (in a larger volume phase) will work in the opposite direction to the stress fields that begin and encourage the spread of the crack. This mechanism will enhance the strength of the hardness as the energy associated with the spread of cracks dissipates in both turn phase and overcome the pressures resulting from the expansion of volume. This process is known as tighter transformation.

b. Types of zirconia ceramics materials obtainable for dental applications

Yttrium tetragonal zirconia polycrystals (3Y-TZP)

According to **Chevalier** (2006)[12], the restoration process could be done using soft machining of pre sintered blanks or hard machining of fully sintered blocks. 3Y-TZP mechanical properties are affected by the grain size (grain sizes (<1 μm). It is less stable and more susceptible to spontaneous t→m., below grain size of about 0.2 μm, the transformation could not be possible, therefore the fracture toughness is reduced. Leading to that the sintering conditions has a strong effect on mechanical properties and stability of final product. Increased sintering temperatures and prolonged sintering times result in increasing in grain sizes. Recently, 3Y-TZP available for soft machining of dental restorations needs final sintering temperatures ranging from 1350 °C - 1550˚C according to the manufacturer.

Gye jeon Gh *et al* (2010)[13]**,** studied he linear sintering behavior of pre sintered zirconia blocks of various densities. The mechanical properties of the resulting sintered zirconia blocks were then analyzed On Three experimental groups of dental zirconia blocks, with a different pre sintering density each, were designed in the present study. Kavo Everest® ZS blanks

(Kavo, Biberach, Germany) were used as a control group. In this study same researcher concluded that density difference of the pre sintered zirconia block did not affect the mechanical properties of the sintered zirconia block, but affected the linear sintering shrinkage of the zirconia block.

C . Zirconia-containing lithium silicate ceramics (ZlS)

Shaymaa E. Elsakaa,, Amr M. Elnaghy (2015)[14], reported that Lithium silicate-based glass-ceramics are Machin able materials could be used with (Computer aided design-computer aided manufacture (CAD-CAM) techniques, with corresponding mechanical properties comparable to those of glass ceramic disilicate lithium. The technique of this new material is to add 10% by weight of zirconium oxide to lithium silicate glass structures. Zirconia crystals act as nuclei but remain in solution in the glass matrix. A double microstructure consisting of $Li2SiO3$ and $Li2Si2O5$ crystals is obtained with a glass matrix containing zirconium oxide in the solution.

The micro structure was achieved in two phases. Glass ceramics in the first crystallized phase contain lithium methylicate crystals which are easy to use. The final crystallization stage, which leads to the microscopic synthesis of double lithium silicate, is obtained after short heat treatment at 840 ° C for 8 minutes. Also, reported that these materials possess mechanical properties (370 to 420 MPa), compared with lithium disilicate glass ceramics. Their mechanical properties are three times higher than those of leucite-reinforced glass ceramics (IPS Empress, IvoclarVivadent, Schaan, Liechtenstein).

In the laboratory test the Weibull coefficient of 8.9 was revealed for this physical group which indicates the quality of uniform and reliable materials. Improved strength and reliability are achieved by adding 8-10% by weight of zirconium oxide with an average granular size of approximately 0.5 to 0.7 μm.

At present, these materials are available as prefabricated industrial fillings for various CAD / CAM systems (for example, Cerec, Sirona, Bensheim, Germany; Artica, KaVo, Leutkirchen, Germany; Ceramill, AmannGirrbach, Pforzheim, Germany) And transparency .

Rinke et al. (2015)[15]**,** Said That ZLS Ceramics offers an excellent combination of outstanding optical properties and high power. Thus, these materials are interesting to manufacture homogeneous restoration. However, although laboratory studies have shown that ZLS ceramics have a positive combination of properties, it should choose the indicator by strict control of the special material handling instructions. This attention to the indicators and treatment instructions is particularly important with respect to the minimum required for the thickness of the wall and the required adhesive flame. Long-term clinical studies are still needed to verify the positive results of the few initial clinical trials available.

Shahmiri (2017)[16]**,** stated that the main difference between lithium disilicate glass ceramics glass ceramics and ZLS in the crystallization resides final stage in the crystalline phase nature: lithium metsilicate with lithium disilicate for ZLS and lithium disilicate only for lithium disilicate glass ceramic. The development of lithium-silicate lithium-containing silicate ceramics demonstrates the continuous search for ceramic materials that provide adequate transparency along with superior mechanical properties. These stable ceramics may provide better reliability than zirconium ceramics but may not represent the endpoint for this task

2. Finishing and polishing

Good finishing and polishing is important for several reasons, such as:

- Ensures oral health and long life of recovery. The smooth surface reduces the possibility of adhesion, which means that sediments are likely to accumulate on a polished surface. This will restore health and last longer.
- The soft tooth surface reduces gum irritation and discoloration of the surface. Thinner teeth are more biologically compatible with gingival tissue, so the health of the gum tissue is maintained.
- Correct identification, finishing and polishing will increase the marginal safety of the recovery process. The interfaces have the maximum possible retention of the BlackBerry. Polishing these surfaces will reduce the risk of injury to patients with secondary caries and gum disease.
- The glossy surface of the tooth increases with a high degree of reflection and refractive index to provide more natural and aesthetic smiles. From the visual point of view, cannot simply leave the restore unstable.
- If the appropriate technique is followed, finishing and polishing greatly enhance the longevity, durability, and long-term wear resistance of the restoration process.

- Finishing and polishing enhances the patient's comfort and satisfaction, and patients greatly appreciate the natural benefits of health and beauty achieved by the restoration process that has been properly restored.

Mopper (2004)[17], points out that the proper finishing and polishing process for renovations is a key element to the success of long-term stable restoration operations. First, appropriate restorative materials, from ceramic materials to hardeners, must be carefully chosen to complete the task perfectly. After that, the dentist must visualize the desired end result and prepare the restoration accordingly. Finally, the proper polishing and polishing technique should be implemented to achieve maximum conciliatory success.

Jefferies (2007)[18], stated that proper finishing and polishing greatly increase esthetic results, maximize patients’ oral health, and increase the longevity of restorations.

The correct sequence of polishing steps necessary for optimum results is often overlooked. Finishing and polishing dental renovations is a sophisticated art form. However, the appropriate technique is actually very simple and very effective once the practitioner understands the concept behind the polishing and polishing process.

The ability of achieving good finishing and polishing on is determined by two important factors: access to the appropriate materials and the technical capacity of the dentist. However, access to the correct materials does not simply mean polishing disks and tapes. The dentist should also be aware that the type of boat used will have a significant impact throughout the healing, endurance, urination and damage resistance period. Achieving a good understanding of available materials and understanding their impact on overall outcomes will increase restorative success.

A.Polishing Materials

Complete finishing and polishing needs the use of series of finishing and polishing discs, burs, paste and strips. Following adequate sequence of materials confirms the long-term perishability and health of restorations. If part of this process skipped, the tooth will be rough and susceptible to staining and plaque. Multi-fluted carbides or fine diamonds for gross contouring can be used to begin finishing the restoration[19].

1. Discs

Mopper (2011)[17]**,** are an advocate of the four-grit disc sequence, which is designed to gradually reduce the amount of roughness caused by initial abrasion until a smooth glossy tooth surface is achieved. To provide maximum control for the operator, composite finishing should be done under low-speed/high-torque (speed from 0 rpm to 30,000 rpms).

Coarse—the coarse grit is the stiffest of all the discs. This grit is used in conjunction with multi-fluted finishing burs for gross contouring and shaping. When used with pressure, the coarse disc makes it easy to blend the composite into the tooth surface, eliminating the white line and raised margins.

Medium—the medium grit should be used to continue smoothing the restoration surface. Medium grits remove any remaining imperfections and marks. Fine—this part of the grit sequence is where polish really starts to shine through. The fine grit helps remove the smallest imperfections while adding a nice luster to the restoration.

Superfine—the superfine grit further refines the surface smoothness attainable to create a highly polished restoration.

Atabek *et al* (2010)[20]**,** stated that discs can be used for the contouring of all tooth surfaces as well as bulk reduction of excess material. Discs will help contour and finish curved surfaces such as labial proximal line angles, lingual marginal ridges, cervical areas, incisal edges, shaping and finishing of incisal corners, plus finishing and polishing of labial surfaces. They are also excellent for contouring and finishing of posterior marginal ridge areas, and for lingual and buccal surfaces.

2. Diamond Strips

It helps start the interproximal finishing process while maintaining the integrity of the interproximal contact. A larger-grit (45µm strip) should be used for interproximal stripping of natural teeth or for gross removal of material, and smaller grits (15 µm and 30 µm) should be used to start interproximal polishing[17].

3. Aluminum Oxide

Strips should be used to contour and polish interproximal areas. Use of a high-quality strip will remove tenacious stains and create a high polish at the interproximal without damaging the soft tissue. It is important that the strip isthin and will stay intact as it is drawn through the interproximal contact areas.

4. Oxide Cups and Points

Radz (2011)[21]**,** suggested that Aluminum oxide cups should be used to polish gingival margins, achieve labial characterization and anatomy, and effectively reach areas such as the gingival third and the gingival margins of anterior teeth. Aluminum oxide points should be used to create labial grooves in veneers, to finish and polish occlusal surfaces of posterior teeth, and on lingual surfaces of anterior teeth. An aluminum oxide polishing paste should be used as the last step in the finishing and polishing process. Polishing paste with felt discs and points can be used to bring out the final beautiful polish of composites, metals, porcelain, or natural dentition after prophylaxis.

3. Translucency of Dental Ceramics

Since human tooth enamel is highly translucent, translucency is a desirable characteristic of dental ceramic materials. Translucency is emphasized as one of the primary factors in controlling the esthetic outcome because it makes restorations appear more natural[22].

Harianawala (2014)[23]**,** also defined translucency as the ratio of the intensity of the transmitted light to that of the incident light. Opacity is the inverse of the translucency, and optical density is the common logarithm of the opacity. In the development of a method for measuring translucency, the following facts proved to be important:

(1) Only visible light is of interest

(2) The eye is most sensitive to a wavelength of approximately 550 nm

(3) Light transmitted through a body decreases exponentially with an increase in thickness.

Translucency can be studied by measuring direct transmission (when light goes through without a change in direction or quality), total transmission (combination of direct and diffuse transmission) and spectral reflectance (fraction of incident light that is reflected at an interface such as porosity).

Lee (2015)[22], stated that Requirements for dental esthetic materials are contradictory. Translucency of restorative materials influences the masking ability and color blending effect..

As dental ceramics evolve and patients' demands for esthetic restorations increase, guidance in selecting an appropriate ceramic system when faced with different esthetic demands was offered. Considering the translucency and the mechanical strength of dental ceramics simultaneously, high-translucency ceramics should be used when high-level esthetics are required, since high-strength ceramics tend to be more opaque and pose a challenge when trying to match tooth color.

All-ceramic restorations have been advocated for superior esthetics. As to the optimization of the translucency of dental ceramics, the biomimetic simulation of natural tooth microstructure might be a promising method.

Xiong *et al* (2008)[24], also refers to the term translucency is used to describe the optical property, the corresponding term transmission is a physical term which represents the ability of a medium to permit light to pass through it.