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Indirect Esthetic Restorations in Anterior Dentition- A Review

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Abstract: ***In daily clinical practice, the most common concern of patients is the esthetics of anterior teeth. Conservative treatments should always be the first option for the solution of aesthetic problems involving morphological changes and usually provide the better result that the patient expects. In this context, various indirect esthetic restorations are capable to provide an extremely faithful reproduction of natural teeth with great periodontal biocompatibility and better esthetics. This review article briefly describes various methods of indirect restorations and some of its recent advancements.***

Keywords: Veneers, Ceramics, Dental porcelain, Composite

1. Introduction

Esthetic dentistry can be defined as, "the skills and techniques used to improve the art and symmetry of the teeth and face to enhance the appearance as well as the function of the face, teeth as well as oral cavity"[1]. It also provides certain benefits that extends beyond dental health and tends to improve physical attractiveness. Each of us are unique in terms of our beauty, different smiles, styles, interpretations certain expressions and so on. As new restorative materials had evolved, one's own expectation in choosing materials have got improved. Over the past 30 years, range of options for the dentists in order to choose the materials had changed dramatically. In the middle of 20th century silicate cements were only the restorative options and were replaced by arylic resins. Indirect restorations are those which are fabricated outside the mouth. After the tooth preparation impressions are taken and are sent to laboratory. As contrast with direct restorations these possess certain advantages that it has no polymerization shrinkage.Direct restorations are those restorations that are directly placed over the tooth.Silicate cements were replacedby acrylic restorations in the middle of 20th century and eventually Composites had evolved to replace acrylic resins

2. Indirect restorations and its importance

Indirect restorations are those fabricated outside the oral cavity[2]In some situations indirect composite resin restorations offer distinct advantages over direct composite resin restorations. When a composite resin is polymerized, polymerization shrinkage occurs in the resin matrix. With the direct technique, such shrinkage can cause a marginal gap where the bond strength is the weakest, such as at the dentin-composite resin interface. When composite resin is polymerized in the laboratory by light, heat, or other methods, the shrinkage occurs before the restoration is bonded into place, thus only a thin layer of luting composite resin is subject to shrinkage at the tooth-restoration interface. This results in less marginal gap, which reduces the likelihood of marginal leakage, sensitivity, recurrent decay, and staining.Indirect techniques allow the dentist to incorporate the skills of the cosmetic dental laboratory technician [3]inorder to create a better smile

3. Importance of smile design

The principles of smile design require an integration of esthetic concepts that harmonize facial esthetics with the dental facial composition and the dental composition. The dental facial composition includes the lips and the smile as they relate to the face. The dental composition relates more specifically to the size, shape, and positions of the teeth and their relationship to the alveolar bone and gingival tissues. Therefore, smile design includes an evaluation and analysis of both the hard and soft tissues of the face and smile.The width of the face is the width of five ''eyes'[4]

4. Adhesion

Adhesion is defined as a state in which two surfaces are held together by interfacial forces, which may consist of valence forces, or interlocking forces or both. In other words adhesives fills the gap in between two surfaces [5]An inlay or a crown is frequently stressed similarly to a beam in a three-point bending test. If loaded from the occlusal surface, the inner surface of the ceramic restoration is subjected to tensile stress. Such situations are also possible with veneers. Ceramic is a brittle material, and always contains micro cracks at the surface because of the finishing procedures. These micro cracks can propagate under load, even a moderate load, after fatigue of the biomaterial, with

subsequent catastrophic failure There are two ways out of this problem: (1) improve the mechanical characteristics of the ceramic material, which leads to high strength ceramics (not suitable for veneers owing to their high opacity), or (2) eliminate/ prevent the crack propagation at the inner surface of the restorations. This is done with adhesive techniques.

5. Veneers

A veneer is a thin layer of restorative material placed over a tooth surface either to improve the aesthetics of a tooth or to protect a damaged tooth surface[6]. There are two main types of material used to fabricate a veneer, Composite and Dental porcelain. A composite veneer may be directly placed or indirectly fabricated by a dental technician in a dental laboratory, and later bonded to the tooth, using a resin cement. In contrast, a porcelain veneer may only be indirectly fabricated. Bonded porcelain veneers have a number of significant advantages over metal-ceramic or all-ceramic crowns.Ceramic laminates give better color stability and wear resistance as compare to direct composites

5.1 Porcelain Laminate Veneers

Ceramic veneers were used more frequently in 1920s and 1930s.[7]From the initial introduction of porcelain, the use of it in porcelain-fused-to-metal (PFM) applications has achieved the most popularity. Through the years, this system has proved to be beneficial not only for use in the posterior region but also in the Anterior, where esthetics are an especially important issue. However, this technique, impairs the transmission of light. If the gingival tissues are thin, the marginal soft tissues near the metal collars that have been placed subgingival may appear to be dark. Since the ceramic layer is quite thin and opaque, this is a common occurrence, interfering with the transmission of light through the labial gingival tissues, owing to the shadows created by the porcelain fused- to-metal restorations with labial butt joint designs. When there is no metal coping, natural teeth, all-porcelain jackets, and cast glass ceramic crowns allow light transmission.

5.2 Composite Laminate veneers

Many composite resins wear much like natural tooth structure and do not cause iatrogenic wear of the opposing dentition. Indirect composite resin laminate veneers are the treatment of choice in many situations like Darkly stained tooth.Tooth preparation for composite veneers is more conservative in nature as it doesnot require muchtooth structure reduction as like porcelain where 0.5mm of tooth structure reduction necessary as to accommodate space for porcelain

6. Ceramic restorations

6.1 All ceramic restorations

For many decades, porcelain jacket crown was the most esthetic full-veneer restoration dentistry had to offer. It was made from high fusing porcelains using platinum foil for support during firing.its main disadvantage was that it had got the tendency to fracture hence its use is limited to single anterior tooth especially incisors. Hence the need comes to introduce more materials of naturally acceptable type as well as strength

6.1.1 Highly filled glass-ceramic restorations

The highly filled glass-ceramic restorative materials were introduced in 1990 as IPS Empress, now known as IPS Empress Esthetic. The leucite-reinforced glass-ceramic is heat-pressed into a phosphate-bonded investment, forming either a core or a completed monolithic restoration.The second restorative option in the highly filled glass-ceramic family is the lithium disilicate–reinforced material, E.max.

Figure 1: Highly filled glass ceramic restorations

6.1.2Alumina reinforced substructures

The first high-strength core ceramic was a glass-infiltrated alumina, slip mixed to a thin, creamy consistency is brushed onto the die in a method called slip casting. The alumina is fired, or sintered, in a furnace, which fuses particles together without completely melting them[8].In a second firing process, glass is applied to the surface of the porous core and infused, or absorbed, into the porous core material by capillary action. The densely packed alumina crystals limit crack propagation, and glass infiltration eliminates residual porosity

Figure 2: Alumina reinforced substructure

6.1.3 Zirconia reinforced substructures

It is the strongest of the glass infiltrated core materials. The final glass infiltrated core contains about 30% zirconia and 70wt% alumina [8]. Due to its radiopaque naure its use is limited to posterior restorations and in case of teeth with severe discoloration this property is used to mask the defect in case of anterior teeth. The property of phase transformation from monoclinical phase to tetragonal phase. The most important property of zirconia is phase transformation. On cooling it transforms from its original monoclinical phase to tetragonal phase causes high internal stresses[9]and increase in volume from 3% to 5%.This defines the strength of zirconia crowns

Figure 3: Zirconia reinforced substructure

6.2 Metal ceramic restorations

The metal-ceramic restoration, also called a porcelain-fused to- metal restoration, consists of a ceramic layer bonded to a thin cast metal coping that fits over the tooth preparation. Such a restoration combines the strength and accurate fit of a cast metal crown with the cosmetic effect of a ceramic crown. With a metal understructure, metal-ceramic restorations have greater strength than restorations made of ceramic alone. In case of anterior metal ceramic crowns,a uniform reduction of approximately 1.2 mm is needed over the entire facial surface. To achieve adequate reduction without encroaching on the pulp, the facial surface must be prepared in two planes that correspond roughly to the two geometric planes present on the facial surface of an uncut tooth.

7. Impression procedures for indirect restorations

A dental impression is a negative replica of the teeth, alveolar ridge and adjoiningtissues. It is converted into a positive replica using various materials.The positive replica of a single tooth is called as a 'Die' and positive replica of a whole arch or part of it is known as 'Cast' or 'Model'.

Since elastomers shrink on polymerization, a small volume of material will reduce the net effect of shrinkage on the accuracy of the impression. A closely adapted tray uses only a small amount of material.In case of condensation silicone a heavily filled putty version reduces the shrinkage whichis effectively converts stock tray into close fitting custom tray. As a second step light filling(high shrinkage)material(wash) is placed inside this tray and closely reseated.This is two stage putty wash method.

One stage impression technique can also be used, as decreasing the number of steps should increase the efficiency and placing both materials in single tray would be an attractive option

8. Recent advances in Indirect restorations

8.1Stacked/feldspathic teeth veneers

These veneers contain many stacks of porcelain giving rise to multiple layers in the veneer. Feldspars are naturally occurring aluminium silicate containing sodium or potassium. The feldspars contain fluoroapatite crystals improving the optical appearance of the tooth. It has a polychromatic appearance and high translucency, hence closely resembles the natural tooth. Hence it is of great esthetic value. It is the highest quality cosmetic veneers.

Figure 4: Stacked/feldspathic teeth veneers

8.2Lithium disilicate veneers

They are the most widely used true glass ceramics. It is versatile and is stronger than other porcelain veneers . It has a high flexural strength and available in a variety of shades. It has high resistance to thermal shock thus managing the problem between two similar materials. It is used for teeth which requires minimal reshaping.

Figure 5: Lithium disilicate veneers

8.3 Minimally invasive/no preparation veneers

8.3.1 Lumineers

They are exceptionally thin veneers (0.3mm) made of a special cerinate porcelain. Cerinate is material made of feldspathic porcelain reinforced with leucite crystals. They have low thermal expansion. They can be easily placed with minimal invasion and pain.[10]

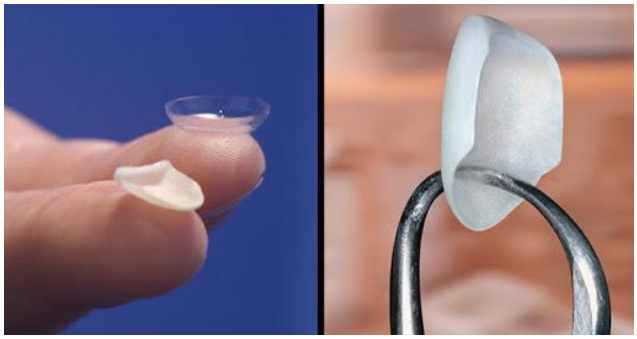

Figure 6: Lumineers

8.3.2 Durathin veneers:

These veneers are exceptionally thin and are about 0.2 mm whereas the traditional veneers are usually about 0.5 mm thick. These veneers have gained popularity due to its good esthetic effects as it gives a natural translucency to the teeth closely resembling natural teeth. This is one of the advantages that durathinveneers have over lumineers as lumineers have an opaque appearance thus failing to give a natural effect.

Figure 7: Durathin veneers

8.3.3Vivaneers:

These are extra tough veneers with a thickness of about 0.3 mm and hence need a minimal thickness of about 0.3 mm.

Figure 8: Vivaneers

8.3.4 MAC veneers

(Microadvanced Cosmetic Division veneers) They are pressed ceramic veneers. They are manufactured in Microdental laboratories. They have high strength and are denser than other veneers. They are a bit thicker when compared to other veneers which ensures that these veneers can firmly adhere to the tooth surface and are not displaced from the teeth. They are also stain resistant.

Figure 9: MAC Veneers.

9. Failures of indirect restorations

Porcelain veneers are not appropriate for aesthetic restoration of all anterior teeth. Careful selection of the teeth to receive the veneer is necessary to ensure satisfaction. Long-term success is measured by continued aesthetic satisfaction, durability without becoming dislodged or fractured, the absence of visible surface or peripheral staining, and functional harmony with the other teeth

1) Fracture of the restoration like separation of porcelain from the preparation
2) Loss of esthetics as result of improper shade in case of severly stained teeth
3) Improper contact areas
4) Loosening of restorations
5) Fracture of teeth
6) Over protected /underprotected gingiva
7) Recurrent caries due to marginal leakage

10. Conclusion

Significant advances in porcelain technology have permitted increased versatility in its use as a restorative material. When combined with acid-etch bonding techniques, porcelain laminateveneers are a more conservative and highly esthetic alternative to full coverage restoration in appropriate clinical situations. Composite resins have a promising future in dentistry. The technology has progressed over the years, and bonding agents will ensure strong, long-lasting adhesion to tooth structure. However, ceramic materials such as E Max and monolithic Zirconia provide viable alternatives.

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