Guide and Insight to Finishing and Polishing in restorative dentistry- A review

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Abstract:

Objectives:To provide readers with enhanced awareness and a broader understanding of the principles and tools available to create optimal dental restorations. The article aims to equip readers with the significance of finishing and polishing as well as the advancements in materials and technologies.

Clinical Significance: This article encourages clinicians to stay updated and informed about the latest advancements in order to deliver the best possible and long lasting dental restorations while maintaining optimal oral health.

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INTRODUCTION :

A smooth surface finish is a desirable feature for a satisfactory dental restoration[1]. When a restoration is placed in the mouth, it should feel as smooth and natural as possible to avoid irritating the surrounding soft tissues or causing discomfort to the patient.

Finishing and polishing of dental restorations are essential steps in the clinical restorative process. Proper finishing and polishing techniques help to remove any roughness or irregularities on the surface of the restoration, creating a smooth and polished surface[2]. This not only improves the esthetic appearance of the restoration, but also reduces the likelihood of plaque accumulation and staining, which can lead to decay or discoloration of the restored tooth.

In addition to esthetics and longevity, proper finishing and polishing can also help prevent occlusal interferences and premature wear of opposing teeth, ensuring a proper occlusal function[3-5]. Therefore, it is important to pay attention to the details of finishing and polishing to achieve the desired outcomes for dental restorations.

The process of finishing and polishing dental restorations typically involves the use of a sequence of abrasive materials, which are applied to the surface of the restoration in order to remove any surface irregularities and produce a smooth, polished surface[6].

The abrasives used in this process are typically made of materials such as diamond, silicon carbide, or aluminum oxide, which are harder than the surface of the restoration[7]. The sequence of abrasives typically starts with a coarse abrasive material that removes the largest surface irregularities, and then progresses to finer and finer abrasives in order to produce a smoother and more polished surface.

The goal of this process is to produce a surface that is free from scratches or other surface irregularities, which can contribute to plaque accumulation and other dental problems[8]. By utilizing a sequence of abrasives of progressively smaller dimensions, it is possible to achieve a highly polished surface that is both esthetically pleasing and functional.

IMPORTANCE OF FINISHING AND POLISHING:

Finishing and polishing of dental restorations is an important step in the restorative process, as it can help to ensure proper function, esthetics, and longevity of the restoration. Here are some of the key reasons why finishing and polishing are so important:

1. A smooth surface finish can help prevent plaque accumulation and reduce the risk of tooth decay and gum disease. A rough or uneven surface can create spaces where bacteria can accumulate and grow, increasing the risk of dental problems[9].

2. A smooth surface can improve the appearance of the restoration, making it look more natural and blending in with the surrounding teeth. This is particularly important for restorations in the front of the mouth, where esthetics are especially important.

3. A well-polished restoration can help to improve the patient's oral health and overall well-being, by reducing the risk of dental problems and promoting better oral hygiene habits.

4. Proper finishing and polishing can help to ensure that the restoration fits well and does not interfere with the patient's bite or cause other problems with the surrounding teeth.

5. Finally, a well-finished and polished restoration can help to ensure its longevity, reducing the need for costly and time-consuming repairs or replacements in the future.

MECHANISM OF ACTION

The principles involved uses a tribology concept. This concept is associated with the material science, physics, chemistry and surface contact engineering[10].

The experimental parameters that are typically considered in a tribological system include the applied load, velocity, and duration of motion. These parameters can have a significant impact on the behavior of the system, and can be adjusted in order to study different aspects of the system's performance.

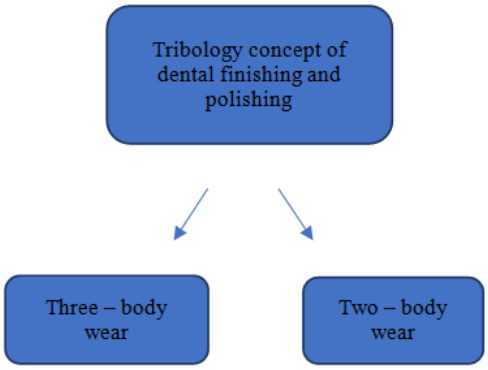
The structure of the tribological system is also an important consideration, and can include the two bodies in contact, the interfacial media (such as lubricants or coatings), and the surrounding media (such as air or water).

Two- body abrasion and three- body abrasion are two different types of abrasive wear that can occur during the finishing and polishing of dental restorations.

In two-body abrasion, a solid abrasive particle is fixed to the polishing substrate and is used to abrade the surface of the restoration. This type of abrasive wear is typically used in dental finishing and polishing devices such as diamond burs or polishing discs.

In three-body abrasion, loose abrasive particles are present between the surface of the restoration and the polishing substrate, creating a slurry. The abrasive particles in the slurry abrade the surface of the restoration, producing a smoother and more polished surface. This

type of abrasive wear is typically used in dental finishing and polishing devices such as polishing pastes or rubber cups[11].



FACTORS AFFECTING FINISHING AND POLISHING OF COMPOSITES

Particle size and shape of the polishing material: The size and shape of the abrasive particles used in the polishing material can have a significant impact on the quality of the finished surface. Smaller, more uniform particles tend to produce a smoother surface, while larger, irregular particles may produce a more rough or uneven surface.[12]

Pressure and speed of the polishing instrument: The amount of pressure and speed at which the polishing instrument is applied to the composite surface can also affect the final surface texture. Too much pressure or speed can cause excessive heating and melting of the composite, while too little pressure or speed may not produce a smooth enough surface.

Water or cooling agent: The use of water or a cooling agent during the polishing process can help to reduce heat buildup and prevent damage to the composite surface. However, excessive use of water can also interfere with the polishing action and reduce the effectiveness of the abrasive particles[12].

Composite material type and composition: Different types of composite materials have different properties that can affect the finishing and polishing process. For example,

some composites may be more prone to discoloration or staining if not polished properly, while others may be more difficult to polish due to their hardness or stiffness.

Finishing and polishing technique: The specific technique used for finishing and polishing the composite can also have an impact on the final surface texture. Different techniques may be more effective for achieving different types of surface finishes, such as high gloss or matter.

INSTRUMENTS USED:

The main types of instruments that are commonly used for stepwise finishing and polishing of composite restorations in dentistry[13].

Gross contouring: During this stage, burs and diamonds are often used to remove excess composite material and shape the restoration to the desired contour.

Finishing: Once the gross contouring is complete, finer instruments such as discs, cones, wheels, cups, and rubber points can be used to further refine the surface of the restoration and remove any remaining rough spots or irregularities. These instruments are typically made of materials such as silicone or diamond, and may vary in size and shape depending on the specific area of the restoration being polished.

Polishing: The final stage of finishing and polishing involves the use of bristles, cups, and cones that are designed to produce a high-gloss surface finish. These instruments are often made of materials such as felt or rubber, and are typically coated with a polishing agent or paste to help achieve the desired surface texture.

ACQUIRED: INHERENT POLISH RATIO

There are two types of surface polish: acquired and inherent.

Acquired polish is the surface finish produced by the dental practitioner during the restorative procedure, using finishing and polishing instruments. This type of polish is relatively smooth and shiny.

Inherent polish, on the other hand, is the surface finish that develops naturally over time as a result of mastication, wear, and erosion. This type of polish is largely determined by the size and solubility of the dispersed phases (e.g., fillers, fibers) in the material. Over time, the softer matrix material wears away more quickly than the harder filler particles, resulting in a rougher surface texture.

The acquired-to-inherent polish ratio (A:I ratio) is a measure of how much the surface texture of a material changes over time. If the A:I ratio is 1:1, then the surface texture will remain relatively constant over time. However, if the A:I ratio is greater than 1:1, then the surface will become rougher over time as the softer matrix material wears away more quickly.

Microfilled composites tend to have a low A:I ratio because both the filler and matrix materials are similar in size and solubility. This means that the surface texture will not change significantly over time.

Large-particle macrofilled composites, on the other hand, tend to have a high A:I ratio because the filler particles are much larger and harder than the matrix material. This means that the surface texture will become rougher over time as the softer matrix material wears away more quickly.

RECENT ADVANCEMENTS:

One-step polishing systems:

These systems use a single polishing instrument that can be used to both finish and polish the restoration. They are designed to be more efficient and faster than traditional multi-step systems, saving time and improving patient comfort[14]. Eg: ProGloss, OneGloss is a one step composite polisher.

Diamond-impregnated polishing instruments [Profin PDX System]:

These instruments are coated with diamond particles, which can achieve a high level of surface smoothness and gloss. They are particularly effective for polishing ceramics and hybrid materials.

The Profin PDX System is a recent advancement in dental polishing technology that utilizes a combination of diamond-impregnated polishing instruments and a specially designed handpiece to achieve a high-gloss surface on dental restorations.

The Profin PDX System consists of a range of diamond-impregnated polishing instruments with varying grit sizes, which are designed to be used in a stepwise manner to remove surface imperfections and achieve a smooth, glossy finish[15]. The system also includes a specially designed handpiece with a unique oscillating motion that helps to reduce heat generation and minimize the risk of damage to the tooth structure.

One of the main advantages of the Profin PDX System is its ability to achieve a high-gloss surface on a wide range of dental materials, including composites, ceramics, and metal alloys[16]. The system is also designed to be highly efficient, allowing for rapid removal of surface imperfections and minimal reduction of restoration volume.

Additionally, the Profin PDX System is user-friendly and can be easily integrated into existing dental practice workflows. The system is also relatively cost-effective, making it an attractive option for dental practices of all sizes.

Air-Particle Abrasion Technology

Air-particle abrasion technology is a dental technique that involves the use of a stream of abrasive particles propelled by compressed air to remove dental material, such as tooth structure or restorative material, from a tooth surface.

The abrasive particles used in air-particle abrasion technology can be made of various materials, such as aluminum oxide, silica, or glass beads, and come in different sizes and shapes[17].One advantage of air-particle abrasion technology is that it is a minimally invasive technique.

The EMS AIR-FLOW HANDY system is a recent advancement in air-particle abrasion technology that uses sodium bicarbonate as the abrasive. The system consists of a specially designed handpiece with a narrow nozzle that delivers a stream of compressed air and sodium bicarbonate powder to the tooth surface.[18]

One advantage of the EMS AIR-FLOW HANDY system is its ability to effectively remove biofilm, superficial stains, and young calculus from natural teeth, implants, and restorations. This system can be used as an alternative to traditional rubber cups and polishing pastes, which may have limitations in accessing certain areas of the mouth.

The sodium bicarbonate powder used in the EMS AIR-FLOW HANDY system is gentle and effective, and can remove surface stains without damaging the tooth structure or causing discomfort to the patient.[19] The system is also designed to minimize the production of aerosols, which can reduce the risk of transmission of infectious agents in the dental office.

Overall, the EMS AIR-FLOW HANDY system represents a significant advancement in air-particle abrasion technology and offers a safe and effective alternative to traditional polishing methods for achieving optimal dental hygiene and aesthetics.

Abrasive impregnented brushes:

Abrasive-impregnated brushes are another recent advancement in dental finishing and polishing technology. These brushes are made up of bristles that are impregnated with abrasive particles, such as diamond or aluminum oxide, which are then used to remove surface imperfections and achieve a smooth surface on dental restorations[20].

One of the main advantages of abrasive-impregnated brushes is their ability to access hard-to-reach areas and contours of dental restorations, such as the interproximal spaces or the occlusal surfaces of molars. This makes them particularly useful for finishing and polishing composite restorations, which can be challenging to access and polish effectively with traditional polishing techniques[21].

Another advantage of abrasive-impregnated brushes is their ability to achieve a high-gloss surface on dental restorations, while minimizing the risk of damage to the underlying tooth structure. They are also relatively easy to use and can be integrated into existing dental practice workflows, making them a convenient option for dental professionals[22].

Overall, abrasive-impregnated brushes represent an important advancement in dental finishing and polishing technology, and offer an efficient, effective, and convenient solution for achieving optimal aesthetics and function on a wide range of dental restorations[23].

Nanotechnology- Liquid Polish:

Nanotechnology-impregnated polishing systems are a relatively recent advancement in dental finishing and polishing technology. These systems use abrasive particles that have been coated with nano-sized particles, such as silica or zirconia, which are designed to enhance the polishing and finishing properties of the abrasive particles[24].

The use of nanotechnology in dental polishing systems offers several advantages over traditional polishing systems. One of the main advantages is that the nano-sized particles can provide a more uniform distribution of abrasive particles on the surface of the dental restoration, which can lead to a more consistent and predictable finish.

Another advantage of nanotechnology-impregnated polishing systems is that they can reduce the risk of damage to the underlying tooth structure, since the nano-sized particles are less likely to cause micro-fractures or surface damage on the restoration.

Nanotechnology-impregnated polishing systems are also designed to be easy to use, with minimal setup time and a streamlined workflow. This makes them a convenient option for dental professionals who are looking to improve the efficiency and effectiveness of their finishing and polishing procedures.

ProGloss – One step Composite Polisher

Profin -PDX system

Occlubrush: Each bristle is a polishing instrument. Special Fibres with In-Built Silicon Carbide Abrasive Particles

Air abrasion technology

CONCLUSION:

The finishing and polishing procedure is crucial in achieving successful restorations clinically. The selection of appropriate abrasives and the sequence of their use play a significant role in determining the quality of the finished restoration. It is essential to start with coarse abrasives to remove any excess material and then move on to finer abrasives to achieve a smooth and polished surface.

It is also essential to consider the material being abraded as it can affect the rate of abrasion and the type of abrasives required. Overheating during the process should be avoided as it can lead to damage to the restoration and surrounding tissues. Clinicians should also be careful not to over-finish margins and contours of the restoration, which can affect its structural integrity and longevity.

By adopting a definite sequence of abrasives, clinicians can achieve a mirror-like polish, which is not only aesthetically pleasing but also helps in maintaining the restoration's longevity.

It is important for clinicians to stay updated with the latest advancements in finishing and polishing technology to provide the best possible outcomes for their patients.

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