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Comparative evaluation of clinical efficiency of application of pit and fissures sealant performed under microscope and loupes

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Abstract
Aim: To compare the clinical effectiveness of pit and fissure sealants applied under naked eye, magnifying loupes, and microscope.
Materials and Method: This study was carried out on 30 permanent molar teeth of patients aged between 6-9 years. The clinical examination of all patients included visual inspection with the aid of a dental mirror, probe, explorer, cotton rolls, and radiographic imaging. Sufficient lighting was also utilized during the examination. The study was divided into three groups. The procedure for the application of pit and fissure remains the same. However, group A was performed under naked eyes, group B under magnified loupes, and group C under a microscope. After the procedure teeth were analyzed for retention.
Statistical Analysis Uses: Statistical analysis used was Rydges Criteria with a comparison of results from the same.
Results: Observations vary greatly when the sealant is applied clinically vs. with loupes and microscopes. Furthermore, the results demonstrate that bubble formation was among the highly significant criteria on application with naked eyes compared to the microscope and magnifying loupes, which didn't illustrate the same.
Conclusion: The result of this research illustrates that bubble formation on applying pit and fissure sealant suggests that microorganisms could still penetrate the area of the pit and fissure, which might cause dental decay later in life. Teeth with partially retained sealants are more susceptible to developing caries lesions than those with fully covered pits and fissures because particles and food can accumulate in the uncovered areas.

Keywords: Pit and fissure sealant, magnification, caries prevention, magnified loupes, endomicroscope

Introduction
The use of pit and fissure sealants to prevent caries was introduced in the 1960s as a clinical technique. Simonsen proposed a definition of pit and fissure in 1978. He defined it as "a material that is introduced into the occlusal pit and fissures of caries susceptible teeth, thus forming a micro-mechanical bond, protective layer cutting the access of caries-producing bacteria from their source of nutrients." The high caries susceptibility of pit and fissure areas makes them a significant dental problem, and the need to control caries in these areas should be well-established.
Dental Caries in the posterior teeth starts as soon as teeth erupts. Pit and fissure are essential factors in determining the presence of caries. According to G.V black- pit and fissure don't cause caries but instead provide a sanctuary to caries-causing agents. The pit and fissure follow the enamel rod direction and forms a triangle-shaped lesion with its apex at the outer surface and its base towards CEJ. It produces more significant cavitation than proximal caries.
Application done by the naked eye had a variety of disadvantages, such as lack of visibility, bubble formation, and patient movement; magnifications were introduced to overcome such impediments.

Loupes enhance visual acuity, help improve precision and accuracy, lead to more accurate diagnosis, promote better work posture, prevent dental hunchback, reduce musculoskeletal problems, offer an appropriate angle of declination, help reduce eye strain, allow you to focus more and improve hand-eye coordination, can help extend your carrier life, advancement in dental care, cost-effective and easy to work. While loupes make the workspace easy, it also has some drawbacks, such as patient movement, and also loupes are made according to the doctor's eye power
~To overcome the disadvantages of loupes, microscopes were introduced.
The Microscope gives better observation, clarity, and focus. Patient movement does not affect the clarity, can be adjusted and fixed, and is time-consuming; also Microscope has an inbuilt eye power control making it easy for doctors.

Materials and methodology

A randomized *in vivo* study was carried out on 30 permanent molar teeth of patients aged between 6-9 years. The sample size was divided into three groups, with ten teeth per group.

Group I: Pit and fissure application with Naked eyes.

Group II: Pit and fissure application with magnified Loupes with power 4.2x.

Group III: Pit and fissure application with magnification used on a microscope.

This study included teeth with intact occlusal surfaces, deep pits, and fissures but excluded those with developmental defects or existing caries. The clinical examination of all patients included visual inspection with sufficient lighting and the use of a dental mirror, probe, and radiographic imaging to assess the presence of dental caries. Pits and fissures were cleaned thoroughly, containing remaining calculus and debris with prophy paste before pit and fissure sealant was applied. The samples that were not fulfilling the criteria were excluded.

Fig 1: Mouth mirror, Explorer, Cotton rolls, Smart etch, Fissure F, Labomed Microscope, Loupes, Applicator tip

In Group I

The selected teeth were treated with etchant using 37% orthophosphoric acid for 30 seconds, followed by rinsing with water and drying with an airway syringe. Once the enamel had a frosty white appearance, cotton rolls were placed in the buccal and lingual vestibule and pit, and fissure sealant (Fissure F) was applied. The sealant was then cured with a curing light for 30 seconds.

In Group II

During the procedure, magnified loupes with a power of 4.2x were used. The selected teeth were treated with acid etchant using 37% orthophosphoric acid for 30 seconds, followed by rinsing with water and drying with an airway syringe to achieve a frosty white appearance of the enamel. Once this was completed, cotton rolls were placed in the buccal and lingual vestibule and pit and fissure sealant (Fissure F) was applied. The sealant was then cured with a curing light for 30 seconds.

Fig 2: Magnified Loupes

In Group III

During the procedure, a microscope with a magnification of 6x was used. The selected teeth were treated with acid etchant using 37% orthophosphoric acid for 30 seconds, followed by rinsing with water and drying with an airway syringe to achieve a frosty white appearance of the enamel. Once this was completed, cotton rolls were placed in the buccal and lingual vestibule and pit and fissure sealant (Fissure F) was applied. The sealant was then cured with a curing light for 30 seconds.

Fig 3: Microscope

Criteria

	Alpha (A)	Bravo (B)	Charlie (C)
Color Match	The restoration appears to match the shade and translucency of adjacent tooth tissue.	The restorations does not match the shade and translucency of adjacent tooth tissue, but the match is within the normal range of tooth shades.	The restoration does not match the shade and translucency of adjacent tooth structure, and the mismatch is outside the normal range of tooth shades and translucency.
Bubble Formation	No bubble formation visible on the applied surface with intact restoration.	Restoration depicts slight bubble formation on the surface	Majority of the surface is covered in bubble.
Marginal Integrity	The explorer does not catch when drawn across the surface of the restoration toward the tooth, or if the explorer does not catch, there is no visible crevice along the periphery of the restoration.	The explorer catches and there is visible evidence of a crevice, which the explorer penetrates, indicating that the edge of the restoration does not adapt closely to the tooth structure. The dentin and/or the base is not exposed, and the restoration is not mobile.	The explorer penetrates crevice defect extended to the dento-enamel junction.
Surface Texture	Surface texture similar to polished enamel as determined by means of a sharp explorer.	Surface texture is gritty or similar to a surface subject to a white stone or similar to a composite containing super mirror sized particles.	Surface pitting is sufficiently coarse to inhibit the continuous movement of an explorer across the surface.
Gross Fracture	Restoration is intact and fully retained.	Restoration is partially retained with some portion of the restoration still intact.	Restoration is completely missing.

Results

The selected teeth were treated with acid etching using 37% orthophosphoric acid for 30 seconds, followed by rinsing with water and drying with an airway syringe to achieve a frosty white appearance of the enamel. Once this was completed, cotton rolls were placed in the buccal and lingual vestibule and pit and fissure sealant (Fissure F) was applied. The sealant was then cured with a curing light for 30 seconds.

Group I

Fig 4: Clinical Analysis

Criteria

Color match	Bravo (B)
Bubble formation	Charlie (C)
Marginal Integrity	Bravo (B)
Surface texture	Bravo (B)
Gross fracture	Bravo (B)

Group II

Fig 5: Magnified Loupes Analysis

Criteria

Color Match	Bravo (B)
Bubble formation	Alpha (A)
Marginal intergrity	Alpha (A)
Surface texture	Alpha (A)
Gross fracture	Alpha (A)

Group III

Fig 6: Microscopic Analysis

Criteria

Color match	Alpha (A)
Bubble Formation	Alpha (A)
Marginal integrity	Alpha (A)
Surface Texture	Alpha (A)
Gross Fracture	Alpha (A)

Discussion

Pit and fissure materials were initially believed to protect the occlusal surfaces of young children from caries by forming a protective layer. However, it was later discovered through microscopes and magnified loupes that the application technique greatly affects the properties of these materials. As a result, in order to find ionomeric materials with better retention and mechanical properties, microscopes and magnified loupes were utilized in their study.

The technique used in the study effectively achieved the goal of evaluating sealant retention. Results vary greatly when the sealant is applied clinically vs. with loupes and microscopes. Furthermore, the results demonstrate that on application with naked eyes, bubble formation was among the highly significant criteria, which suggests that micro-organisms could still penetrate the area of pit and fissure, which might cause tooth caries later in life in comparison to the microscope and magnified loupes which didn't illustrate the same.

Maintaining good retention of dental sealants to enamel is crucial for long-term clinical success. In the case of teeth with partially retained sealants, the risk of developing caries lesions is higher because food, particles, and biofilm can accumulate in the uncovered pits and fissures. However, in the present case, no carious lesions were found on sealed teeth, regardless of their scores. Even if small amounts of sealant material were found in deeper parts of the pits and fissures, their protective effects against caries lesions still function as a physical barrier, even if they are present as resin tags embedded in etched enamel.

Dental sealants are designed to block caries-susceptible pits and fissures in teeth, making them resistant to caries. Fluoride, which has long been used to prevent dental caries, has been shown to be effective in reducing the onset and progression of dental caries when incorporated into pit and fissure sealants. It acts as a cariostatic agent, reducing demineralization and promoting remineralization.

Preventing tooth decay can be challenging due to the multifactorial nature of caries. However, maintaining good oral hygiene, following a nutritious and balanced diet, using fluoridated mouth rinses, brushing, and sealants can significantly reduce the risk of tooth decay.

Conclusion

Although pit and fissure sealant is known to be one of the biggest breakthrough we saw in field dentistry and is still on the cutting edge to prevent dental decay, it should be taken into account that as the material is benefitting technique with which it is applied should be significant too.

Regulatory Statement

This study took place under all the provisions of the local human subject oversight committee guidelines and policies of ITS Dental College, Muradnagar.

Conflict of Interest

The authors of this manuscript declare that they have no personal, financial, or proprietary interest in any product, service, or company mentioned in this article.

Author's Contribution

Not available

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