



International Journal of Applied Dental Sciences

ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2023; 9(2): 518-524
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www.oraljournal.com
Received: 17-03-2023
Accepted: 16-04-2023

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Isolation in paediatric dentistry: Recent advances

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DOI: <https://doi.org/10.22271/oral.2023.v9.i2g.1768>

Abstract

Isolation of the operating field is a fundamental aspect in pediatric dentistry, which requires greater attention and care in relation to various treatments since the risk of damage to the soft tissues is increased due to sudden movements of children. There must be proper control of moisture, good accessibility and visibility as well as be spacious for instrumentation around the working area. Such an environment is necessary for easy manipulation and insertion of restorative materials.

Keywords: Isolation, rubber dam, isolate system

Introduction

The oral cavity is a complex environment which is surrounded on all sides by hard and soft tissues. Most dental materials that are in use are hydrophobic in nature. Hence, for the success of any dental treatment, a thorough isolated field is mandatory [1]. The presence of saliva as well as microorganisms and lack of control of patient's soft tissues and tongue poses difficulties during dental procedures [2]. There are several challenges in completing dental treatments due to the intricacy of the oral environment. To minimize them, proper isolation is required to control operating field as well as provide safe and quality treatment [3]. Isolation of the working area includes isolation from saliva, blood, gingival crevicular fluid and soft tissues like lips, cheeks, gingiva and tongue [4]. Moreover, good isolation is an important precondition to guarantee the long-term survival of any dental treatment [5].

Goals of Isolation

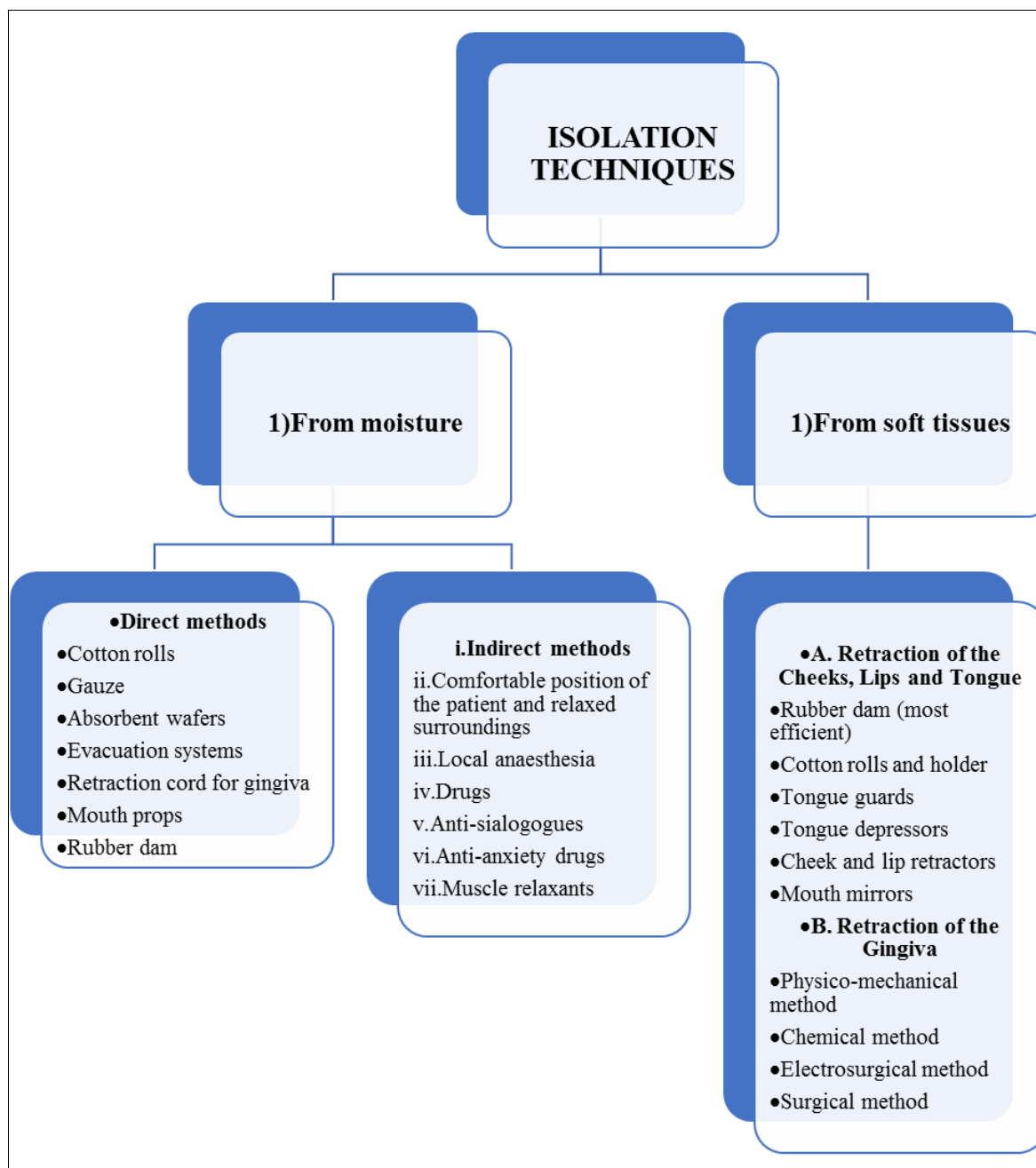
- 1. Retraction and Access:** Retraction and access give the operation site the best possible exposure [6]. The lips, tongue, and cheeks are depressed or drawn back while keeping the mouth open. For this a rubber dam, mouth prop, and retraction cord can be used.
- 2. Moisture Control:** Operative dentistry cannot be performed effectively if the amount of moisture in the mouth is not under control. Moisture control is the process of removing gingival sulcular fluid, saliva, and bleeding from the working area. Additionally, it stops the spray from the handpiece and the fragments of restorative material from being aspirated or ingested. Effective moisture control is made possible by the rubber dam, suction devices, and absorbents.
- 3. Harm Prevention:** A child may unintentionally aspirate small endodontic files, crowns, or restorative debris. Isolation is employed to prevent injury, for patient comfort and operator efficiency [7].

Need for isolation in Pedodontics

1. There is increased salivation in child patient compared to adult patients as well as excessive tongue movement
2. The short attention span of children results in a shorter duration of treatment and therefore better isolation techniques are needed for a good outcome of the dental procedure
3. Decreased danger of aspiration of foreign particles can be achieved through proper isolation

4. Convenience to the operator is noted as it improves visibility of the operative field
5. Improved properties of restorative material have been

6. Isolation techniques also helps in behaviour management in certain patients ^[8]



Rubber DAM

The requirement for working in dry, saliva-free environments has been understood for decades, and the concept of utilising a rubber sheet to isolate the teeth dates back nearly 150 years ^[9]. The introduction of this technique is accredited to a young American dentist from New York, Sanford Christie Barnum, who demonstrated the advantages of isolating the tooth with a rubber sheet in 1864 ^[10]. In 1882, SS White introduced a rubber dam punch similar to that used still now ^[11]. In the same year, Dr Delous Palmer introduced a set of metal clamps which could be used for different teeth ^[9]. Since that time, rubber dam isolation has been considered to be the best isolation technique among all the isolation techniques used for dental resin restorative materials or dental pit and fissure sealants ^[12-15].

Advantages

Rubber dam during endodontic treatment is regarded as the ideal isolation method due to various advantages, as given below:

a. Good moisture control

It acts as a physical barrier which prevents saliva, blood, gingival crevicular fluid, and other restorative debris from disrupting the treatment process ^[16].

b. Safety and medico-legal considerations

The patient's oropharynx is shielded by a rubber dam, preventing the ingestion ^[17] or aspiration ^[18] of instruments/materials and associated debris. Performing endodontic therapy without using rubber dam increases the probability of injuring the patient, and is deemed legally indefensible ^[19] and contrary to recommended guidelines ^[20].

c. Aseptic working environment

Rubber dam isolates the operating field from microbial contamination. It provides a dry and sterile operating field. Saliva contamination of the tooth structure after the acid-etch conditioning prevents the formation of tags and thereby eliminates the potential for the mechanical retention [21-22].

d. Access and visualisation

Rubber dam enhances access to the operating area as the cheeks and tongue are retracted and protected [23].

e. Improved efficiency

Rubber dams make it easier to perform four-handed dentistry during endodontic therapy. Both the dentist and the assistant can focus on the treatment without having to be mindful of guarding the patient's airways or regulating and retracting the soft tissues. Additionally, because rubber dam prevents fluid from building up in the mouth, it eliminates the need for patients to spit or rinse during treatment.

f. Reduced contamination through aerosol

Without rubber dam the aerosol produced contaminates the workplace, which leads to cross-infection for both dental team as well as the patients [24].

Microbial contamination was found to be reduced by 90-98% when a rubber dam was used for isolation, thereby reducing the risk of cross-infection [25].

g. Patient comfort

Majority of patients expressed more comfort during a dental procedure that was performed using rubber dam over one performed without it [26, 27].

Particularly in pediatric dental care, the rubber dam was considered to be an important aid in allowing positive pediatric patient behaviour during dental treatment [17].

Disadvantages

- Lips and gingival injury
- Gingival laceration due to improper clamp choice
- Loss of retention due to lack of clamp springiness
- High placement of rubber dam can obstruct nasal passage
- Worn out clamps can fracture during treatment
- Patient acceptance – time consuming
- Pressure marks on the face due to the frame
- Pooling of saliva

Indication

- Most dental procedures require the use of rubber dam including all operative and endodontic treatments
- Isolation of teeth during thermal test for diagnostic purpose

Contraindication

- When patient has fixed orthodontic appliance
- It cannot be used in partially erupted teeth or extremely mal-positioned teeth
- Patient at risk with transient bacteraemia
- Mouth breathers, patients with upper respiratory infections or asthma
- Psychological intolerance
- Severe gingival disease [28, 29]

New modifications of rubber Dam**1. Instidam (Fig 1)**

It is a single use rubber dam made with translucent natural

latex developed for quick, convenient isolation, and is comfortable for the patient. It comes with an integrated flexible radiolucent nylon frame with pre punched hole off-centre by ½ inch. The pre-punched hole reduces tearing of the dam. By bending the instidam to one side, radiographs can be taken without having to remove the dam. These dams are for one-time use, so there is no need for sterilization [28].

**Fig 1:** Instidam**2. Handidam (Fig 2)**

- The Handidam is already pre-framed, hence traditional frames are not required [4]
- It is simple and takes less time to place
- It gives easy access during endodontic procedures

**Fig 2:** Handidam**3. Optra dam (Fig 3)**

OptraDam® was developed in 2005 (Ivoclar Vivadent AG, Lichtenstein) and requires no clamps or frame [30]. It serves as a lip and cheek retractor along with providing complete isolation as given by a rubber dam. With its innovative inner-ring design, great flexibility, and anatomical shape, it can be inserted without the use of clamps or frame. It is more time and cost efficient compared to the conventional rubber dam, and is available in regular and small sizes. The soft flexible material permits patients to maintain full mobility of their jaw along with added comfort throughout the procedure. The plastic rings' increased flexibility makes it easier to put in the patient's mouth. Due to its anatomical design, a much wider treatment area may be created, and simultaneous total isolation of both arches is possible. It can be kept in place while x-rays are being taken [5].



Fig 3: Optra Dam (Ivoclar Vivadent)

4. Optidam

Opti Dam is the first rubber dam with 3-dimensional (3-D) shape and nipple design. The 3-D shape of Opti Dam and frame is similar to the curves of the mouth, allowing better

access and visibility of the working area. It is also easier to use and has a lower risk of clamp displacement. There is minimal tension on the clamp due to the design and requires less preparatory work. It is available in anterior and posterior dams. It provides the greatest level of patient comfort and permits pressure-free breathing around the nasal area. The powder-free dam contains no corn starch or talc powder, reducing the chance of air borne particles that can cause an allergic reaction.

This anatomical 3-D Thermoplastic frame is safe to autoclave at 134 °C for 3 mins ^[28].

Placement for posterior teeth: (Fig 4)

- Cut nipples according to the position of the tooth
- Position the clamp in one step
- Position the rubber dam behind the clamp's wing
- Slip the rubber dam over the concerned teeth

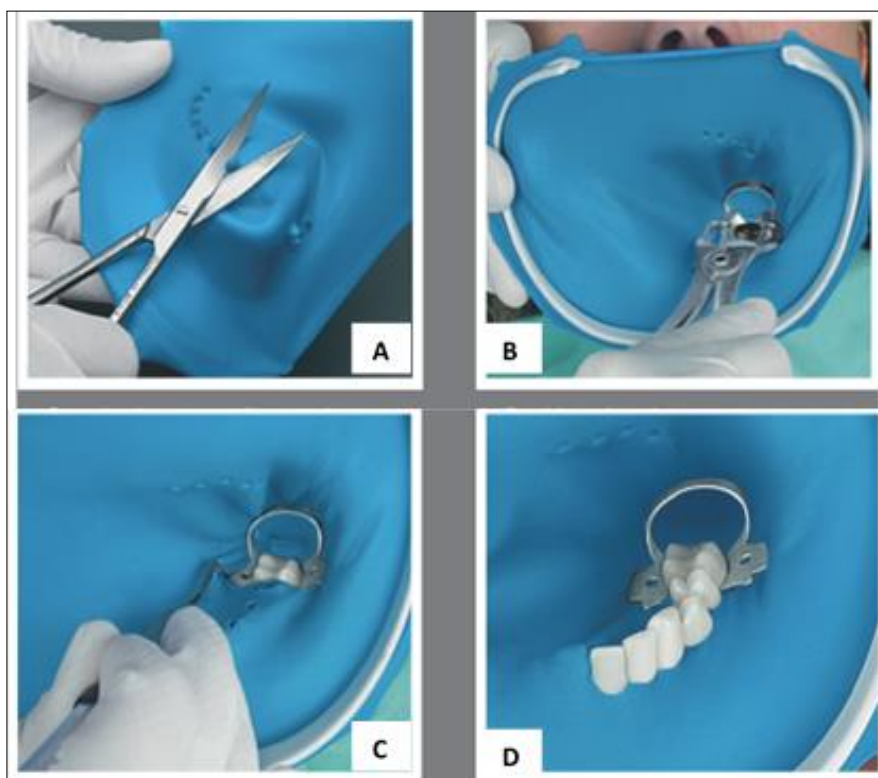


Fig 4: Placement of Optidam for posterior teeth

5. Liquid dam

- It is a resinous material applied on the gingival aspect of the tooth surface before tooth bleaching or any other treatment needing intraoral protection.
- The Liquid dam does not generate any heat when cured and remains flexible even after curing

6. Mini dam

The Mini Dam is a protection device that protects the proximal area of the gingiva during the dental procedure. It is latex-free, simple and comfortably for the patient. The innovative design protects the gingiva from potentially harmful compounds like etching gel while maintaining a relatively dry working environment. It can be stabilized

without using clamps, while still allowing open access and unobstructed view of the treatment area. The operator can pre-stretch the silicone material, which already has holes, and pull it over the teeth to be treated. (Fig 5)

The Minidam is effective in isolation, however it can be used only for proximal lesion restorations and resin infiltration of incipient proximal lesions. Whereas, the rubber dam can be used for a variety of treatment procedures. Research showed that children showcased better behaviour and less perceived pain while the rubber dam was used as compared the use of Minidam. This may be due to the fact that the cotton rolls need to be changed repeatedly and the saliva ejector is used when isolation is done with the Minidam.³¹

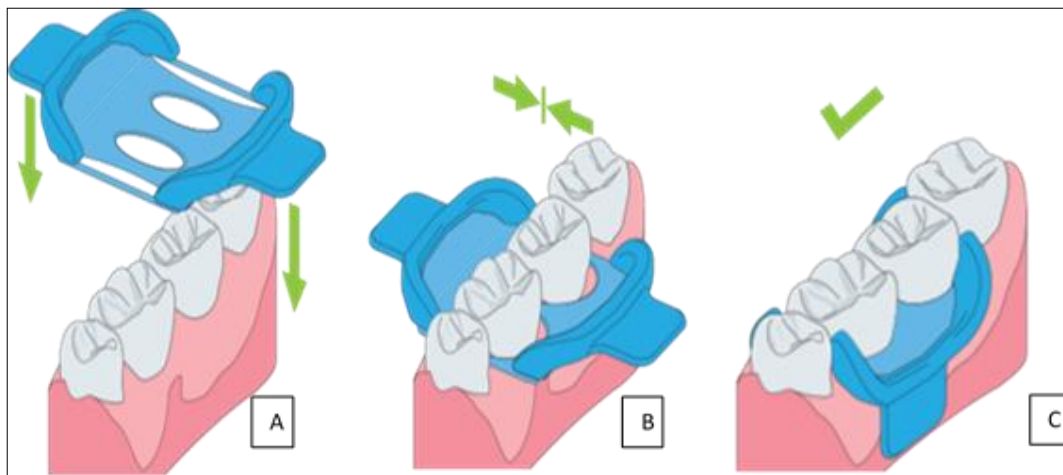


Fig 5: A. Stretch the MiniDam and pull towards the gingiva; B. Release the MiniDam and fold cervically; C. The MiniDam stays in place securely without clamps.

7. Framed flexi dam (Coltène/Whaledent) (Fig 6)

This latex-free flexi dam is available with a built-in-frame which has a working size of 100 mm x 105 mm, ensuring ease in placement without limiting access. When placed against a patient's skin, the plastic frame's smooth surface aids to maximise patient comfort. It also has good tear resistance and is odourless.



Fig 6: Framed flexi dam

8. Dry dam (Fig 7)

A frame is not needed while using the Dry dam. With narrow elastics on either side to go over the ears, it is constructed of a rubber sheet that is positioned in the centre of an absorbent piece of paper. It has an absorbent lining and fits like a face mask to provide patient comfort and lower the likelihood of an allergic reaction. Both medium and thin types are available. It is indicated for anterior teeth isolation, however it cannot be used while bleaching teeth due to the absorbent nature of the paper surrounding it [4].

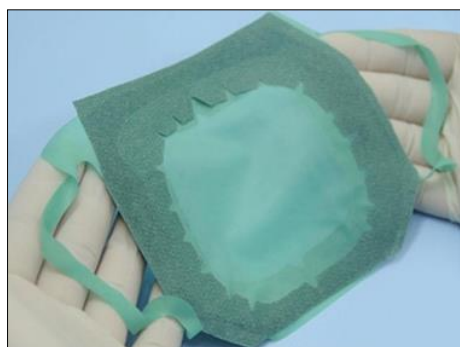


Fig 7: Dry dental dam

Isolite System (Figures 8, 9, 10)

Novel isolation systems have recently been introduced in

dentistry. High-volume evacuation, a biting block, protective barriers for the tongue, throat, and face, lighting, and retraction are all features of these systems. Some systems are made of transparent materials which enhances visibility and permits incorporation of illumination into the mouthpiece (i.e., Isolite, Isolite Systems, Santa Barbara, CA). The intraoral devices are made up of soft, flexible polymer materials that easily adapt to the mouth's contours and provide soft tissue protection. One of the main benefits of these devices is that the operator can treat the opposing maxillary and mandibular quadrants simultaneously. Additionally, it is helpful for young patients with partially erupted teeth where the placement of the rubber dam clamp is difficult.



Fig 8: Isolite system (Santa Barbara, CA)

The Isolite and DryShield (DryShield, Fountain Valley, CA), requires specific armamentarium for each dental unit that is equipped. Another system is Mr. Thirsty (Zirc, Buffalo, MN), which can be connected directly to existing HVEs. Mouthpieces can be single-use (e.g., Isolite system, Mr. Thirsty) or autoclavable and reusable (e.g., DryShield) [28, 32].



Fig 9: Variety of sizes

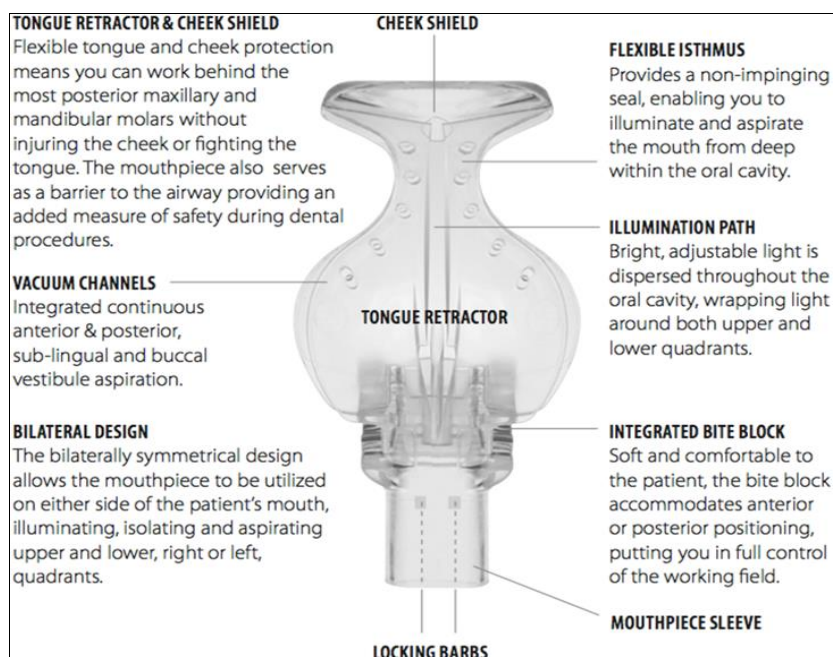


Fig 10: Isolite mouthpiece components

Isolite Isolation procedure

The Isolite mouthpiece sizing "Rule of Thumb" is available which helps to select the right size of the disposable mouthpiece for a patient. (Fig11) Petroleum jelly is then used to lubricate the patients' lips. The cheek shield must be folded in the direction of the tongue retractor in order to fit the Isolite mouthpiece, and the isthmus must be slid into the cheek. The bite block is placed on the occlusal surface and the patient is asked to bite. The tongue retractor and cheek shield are then tucked into the tongue vestibule and buccal vestibule, respectively.

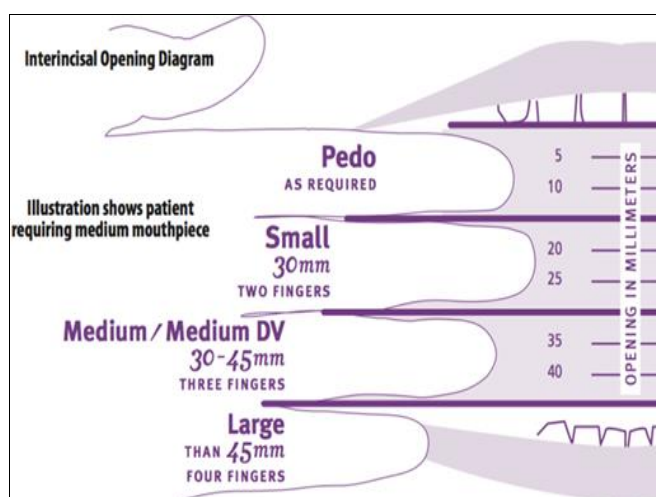


Fig 11: Isolite mouthpiece sizing "Rule of Thumb"

There are limited numbers of studies evaluating the Isolite system in clinical practice.

Patient satisfaction and efficacy of the Isolite system during sealant placement was evaluated in a study. Although patients reported minor discomfort with the Isolite system, there was better time efficiency with the Isolite system when compared to cotton roll isolation^[33]. Three studies found that the Isolite was an effective alternative compared to the rubber dam or cotton roll isolation during the placement of sealants^[32-34].

Behavioural factors to take into account when employing different isolation systems

Both rubber dams and other isolation devices, when used appropriately, can efficiently control moisture and safeguard the soft tissues of the oral cavity. Alternative isolation systems do not require the administration of local anaesthesia, although insertion of rubber dams frequently does. This may give operators the impression that the alternative system is more patient-friendly than the rubber dam. This observation might be particularly accurate for sealants and other procedures when a local anaesthetic wouldn't normally be employed. However, administration of a local anaesthetic is required for operative procedure. A rubber dam therefore appears to be relatively comfortable when local anaesthesia is used and frequently presents as a less bulky isolation approach.

Additionally, research indicates that using rubber dams with paediatric patients may reduce stress when compared to cotton roll isolation. On the other hand, a sizable portion of kids claimed that the alternative isolation system's mouthpiece made them feel like it was stretching their mouths to the point where they felt like they might gag.

Further studies must be conducted on the effect of the alternative isolation devices on the behaviour of patients. Other things to think about include the fact that alternative methods produce more noise and that rubber dams make it easier to breathe via the nose, which can improve the sedative effects of nitrous oxide inhalation^[32, 35].

Conclusion

Although the idea of absolute isolation has been around for more than 150 years and has many benefits, some physicians are reluctant to employ it in everyday endodontic practise^[65]. The time it takes to achieve effective isolation will pay off enormously in terms of both the quality of the patient's care and the decrease of stress. Through numerous research, it has been demonstrated that effective isolation can preserve tooth structure, prevent contamination of the work area, improve visibility and infection management, and guard against iatrogenic mishaps^[36].

Paediatric dentistry places a high priority on causing kids as

little pain and discomfort as possible during treatment. An in-depth understanding of isolation lessens the physical stress placed on the dental team during routine dental treatment, lessens patient anxiety related to dental operations, and improves moisture management, all of which contribute to higher-quality operative dentistry. Researchers are looking into newer isolation methods and materials that would make the process easier for the patient and the operator while still providing a satisfying level of isolation.

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