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RESEARCH ARTICLE

PAIN REDUCTION TECHNIQUES DURING RUBBER DAM CLAMP PLACEMENT IN CHILDREN

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Abstract

Rubber dam is considered as one of the gold standard in the isolation techniques. But often clinicians consider the application of rubber dam as a painful experience for children which brings up an uncooperative behavior in them and it hampers the treatment. The most challenging or painful part during rubber dam application is during the clamp placement. There can be many problems associated with poorly fitting rubber dam clamps. The impingement of clamp to the gingiva can often cause discomfort or painful experience. This review article highlights on various techniques ranging from clamp modification, different anesthetic agents to behavior modification techniques used to alleviate/reduce discomfort during clamp placement.

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Introduction:-

Rubber dam was introduced to dentistry by Dr Sanford C Barnum(1). Formation of aerosols and droplets from air turbines causes contamination of the operating field with blood and microorganism which may be a potential route for transmission of infectious diseases like- measles, tuberculosis, hepatitis and AIDS(2). Thus, use of the rubber dam during treatment, controls these cross-infections and increases treatment efficiency. It also helps in significantly reducing the microbial content from these air turbines in the operative field (3).

Rubber dam has been advocated by the British Society of Pediatric Dentistry for various procedures, including pit and fissure sealants. Its use is crucial for preventing moisture contamination during operative procedures, especially in the lower teeth, where obtaining isolation is a challenge (4). It also improves the accessibility and visibility of the operator. Despite its advantages, placement of rubber dam is cumbersome and can be painful in case of children. There are many problems associated with poorly fitting rubber dam clamps. Improper fitting of rubber dam clamps causes gingival impingement, discomfort, and saliva leakage, resulting in increased procedural time, and negative behavior in children (5).

Anaesthetizing the soft tissue is recommended before the placement of rubber dam clamp which help in reducing the discomfort (4). There are several methods for anesthetizing the soft tissue area along with introduction of clamps with various modifications helps in significant reduction of discomfort during clamp placement. This review article will highlight on the different methods used for pain reduction while applying rubber dam clamp in children.

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Selection of right size clamp

The fit of the rubber dam essentially depends on the choice of the appropriate clamp and its correct positioning. In a pediatric patient, to achieve a good cooperation from the child, selection of appropriate clamp is very important (6). If the width of the clamp prongs is larger than mesiodistal width of the tooth, there would be chances of slippage, gingival impingement and trauma. In such a situation, complete isolation will be difficult around the anchored tooth (7).

Clamp modifications**Cushies (8)**

These are small and soft cashew shaped structures that act as rubber dam clamp cushions. It is placed over the clamp's blade prior to clamp application on the tooth. It increases patient comfort through elimination of contact of the steel clamp with gingiva or tooth enamel, and thus helps to protect the natural tooth structure and costly restorations. It also enhances rubber dam seal by limiting the leakage from above or below the dam and reduces clamp slippage. They are sterilizable (steam and chemical autoclavable) and reusable. It can be applied to one or both the jaws of rubber dam clamps. They are available in two sizes: yellow for anterior and bicuspid clamps and blue for molar clamps.

Soft clamps (9)

A newer clamp is available as a gentle alternative to the metal clamp under the brand name 'Soft Clamp' (Kerr co-operation, Switzerland). This clamp is made up of a radio opaque high-performance polymer. Soft clamps have no sharp edges and its unique design distributes the applied force evenly, reducing the pressure on the contact area. The grip-tight coating of the jaw allows the soft clamp to gently yet firmly engage the tooth surface and also minimises rotation, ensuring a secure and solid retention. It can be accommodated in all types of rubber dam forceps and prevents forceps tips penetrating through the clamp thereby preventing gingival impingement. It is autoclavable and suitable for multiple uses.

Topical anesthetic agents

Using a topical anesthetic can significantly reduce the pain during clamp placement and can anaesthetize the soft tissue. There are several commercially available agents-

EMLA

EMLA cream is a 5% eutectic mixture of local anesthetics. It consists of 2.5% lidocaine and 2.5% prilocaine bases in a 1:1 oil/water emulsion. Vickers et al stated that, in comparison to that of lidocaine and prilocaine, EMLA has a lower melting point of 16 °C. Rapid transmucosal absorption of the EMLA is seen as it becomes liquid at the oral temperature due to its low melting point. (10)

A study by Lim et al in 2003(11) observed that discomfort caused by dental clamps was reduced to a greater extent by the usage of EMLA. Use of EMLA may be highly recommended in keratinized tissue over other topical anesthetics despite of its unsatisfactory taste and increased time of application. Holst and Evers stated EMLA to be more effective specific to palate than other conventional intra oral topical agents. They also found that a good amount of mucosal analgesia in lower buccal fold in children is achieved by EMLA within a time period of 2 minutes (12).

Mucoadhesive patch

Mucoadhesive patch is a topical anesthetic system in which the anesthetic agent is in contact with the oral tissues for a longer time period, thereby increasing the depth of penetration of the agent. The use of a mucoadhesive patch (DentiPatch) may provide an effective anesthesia of gingival tissues to facilitate the painless placement of a rubber dam clamp. The Denti Patch has been approved by the Food and Drug Administration for mild topical anesthesia of the oral mucosa and gingiva before any superficial dental procedures (13)

In a study conducted by Shelly et al in 2002 (14) evaluated the efficacy of muco-adhesive patch (20% lidocaine) in comparison to a topical anesthetic agent (20% benzocaine) in providing gingival anesthesia prior to clamp placement in children. Group 1 had the mucosal patch applied to the gingiva, and the second group had topical anesthetic applied. The study concluded that the denti patch is effective but not superior to topical anaesthetic gel due to its poor adherence to oral mucosa and the extra time taken for application.

Benzocaine , Lidocaine

Benzocaine being an ester base local anesthetic agent is more commonly associated with allergic reaction as compared to amide based local anesthetic due to the structure of PABA .Cardiovascular absorption of benzocaine is hindered due to its poor water solubility. Residues of benzocaine are found for relatively prolonged time period on the applied surface. It is generally manufactured as a spray, gel, gel patch, ointment, or solution as a 6-20% concentration (15).

The only amide based local anesthetic that can be used both as oral and injectable form is lidocaine.Lidocaine is available in various forms such as gel, solution, ointment, spray (16).The action of lidocaine onsets approximately 1-2 minutes from application and remains for a time period of 15 minutes and at approximately 5 minutes its maximum efficacy is seen. Though the potency of 5% lidocaine ointment is found to be similar to 20% benzocaine it has a delayed onset of action with minimum requirement of at least 3 minutes to attain maximum anesthesia (17).Its effectiveness is found to be more on the alveolar mucosa as compared to palatal mucosa.

A study conducted by Richard et al in 2009 (4) compared the efficacy of lidocaine to benzocaine on clamp placement during sealant application in children. Forty five 7-12 year olds, requiring bilateral sealants placement on the permanent first molars were selected for the study. Following the placement of topical anesthetic and the clamp, patients were asked to complete a Faces Pain Scale (FPS) to rate the level of discomfort after clamp placement. The overall difference in the mean FPS ratings was found to be statistically insignificant. The study concluded that the application of lidocaine did not reduce discomfort when compared to benzocaine. However, lidocaine was more effective than benzocaine in the age group 9 and older.

Topical Liposomal Anesthetic Gel

The encapsulation of drugs into liposomes is an alternative form of the local anesthetic drug delivery system since it extends the time of analgesia and reduces central nervous and cardiac toxicity. Several studies have shown that local anesthetics, including lidocaine, when encapsulated in these lipid vesicles provide effective topical anesthesia of the skin. As for the oral mucosa, liposome-encapsulated local anesthetics caused major topical anesthesia. At body temperature, the gel's flowability gets reduced and there is an increase in the anesthetic duration (18, 19).

A study was conducted by Wambier et al in 2018 (20) for evaluating the efficacy of a topical liposomal thermo-sensitive gel during clamp placement for sealants in children. And it was concluded that, the liposomal thermo-sensitive anesthetic gel reduced the pain intensity in children during rubber dam clamp placement.

Behavior modification techniques**Tell show do technique**

It involves verbal explanations at the patient's level of comprehension using acceptable second language or word replacements where applicable, visual presentation, and tactile elements of the procedure in a non-threatening manner, and completion of the procedure without deviating from what has been clarified and demonstrated.

During rubber damp usage, patient can be made familiar with the procedure by using safe or familiar words (euphemism) .Words such as rain coat for rubber dam, rain coat rack for rubber dam frame, tooth ring/ button for clamp are a few examples. This helps in reducing the patient's anxiety level and helps in accepting the treatment in a non-threatening way.

Nitrous oxide sedation

The technique of inhalation sedation with nitrous oxide/ oxygen is an effective method of reducing fear, anxiety and pain improving patient cooperation in children. The primary and safest technique for children is considered to be nitrous oxide/oxygen sedation. Owing to its properties and ease of use, nitrous oxide/oxygen enables good management of children sedated for dental restorative procedure (21). Nitrous oxide/oxygen is easy to administer, titrate and allows good control of depth of sedation. The mechanism of nitrous oxide/oxygen begin with onset of mild sedation, induces mild distraction and has analgesic effect which are beneficial in reduction of anxiety level during dental procedure.

A general fear among children for rubber dam prevails as it comes with fear of suffocation especially during clamp placement. During placement of clamp there is a chance of gingival impingement which causes discomfort.Nitous – oxide /oxygen sedation helps the patient to maintain calm and reduce the anxiety during the procedure. The

knowledge of practitioner on the importance of using distraction and other behavioral guidance is important for a better outcome.

Conclusion:-

Rubber dams are a boon in the field of dentistry especially in pediatric dentistry, but the armamentarium which we choose needs to have a good fit, otherwise it will inflict more pain. As clamps are an essential part of rubber dam, their fit and comfort is integral. So as an operator, we should make sure the clamps don't cause discomfort on application so as to prevent pain and further uncooperative behavior. Use of appropriate anesthetizing techniques before clamp placement and incorporating modified clamps in the armamentarium will be useful for the same. Further research is required in the concept of designing clamps with modifications so that it can overcome the drawback of the metal clamps in terms of gingival impingement, thereby paving the way for a whole new experience of painless rubber dam placement.

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