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Comparative evaluation of Patient Acceptability and Ease of Operator using the Traditional Nygaard Ostby rubber dam frame v/s Modified Nygaard Ostby rubber dam frame

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Abstract

Proper management of moisture and microbes is critical to the success of the restoration process. Rubber dam plays an important role in isolation during dental treatment. Rubber dam frame also plays an important role in rubber dam isolation by holding the whole sheet in the proper place. In Pediatric Dentistry because the face of a pediatric patient is smaller, it requires a smaller dimension of frame for better cooperation of the patient and ease of application. The modified Nygaard Ostby frame was made using three-dimensional printing. The study aimed to compare the traditional Nygaard Ostby rubber dam frame and the modified Nygaard Ostby rubber dam frame. Total 200 pediatric patients were included in the study. They were divided into two groups; Group 1 – Rubber dam isolation with traditional Nygaard Ostby rubber dam frame. Group 2 – Rubber dam isolation with a modified Nygaard Ostby rubber dam frame. A structured & validated questionnaire was given to the operators to evaluate the ease of use of both the rubber dam frames. Likert scale was used to evaluate acceptability of both the rubber dam frames. The result showed that the *p*-value of the need of cutting of rubber dam sheet, ease of operation and patient acceptability is < 0.05 which showed statistical differences in both groups. The study clearly shows that the modified frame shows good patient acceptability and ease of operation compared to the traditional frame.

Keywords: Modified rubber dam frame, Nygaard Ostby rubber dam frame, Patient acceptability, Ease of operator, Traditional rubber dam frame

Introduction

Nowadays, many patients want their dental treatment not only to give good results but also to look like natural

teeth. Resin composites and adhesive systems are known to be particularly property sensitive since proper use and adequate isolation in space are essential for the success and durability of the restoration.[1] This means that the bonding procedure must be performed on a clean tooth that is free of contaminants such as intraoral moisture, saliva and gum/gingival crevicular fluid or blood. [2]

In the context of dental treatment, moisture control plays a pivotal role as it can significantly affect the success and longevity of dental restorations, [3] Contamination with saliva, blood or other oral fluids can compromise the adhesion of dental materials, hinder accurate impressions and increase the risk of postoperative complications.[4] Moreover, the presence of moisture can impede the polymerization of resin-based materials, leading to incomplete curing and reduced restoration durability.[5]

Traditional rubber dam frame has bulky design which might lead to blockage in the vision and nasal pathway of patient and leads to patient in-cooperation. While doing rubber dam isolation with traditional rubber dam frame, it requires a whole rubber dam sheet for the isolation in each patient. The modified rubber dam frame was lesser bulky design compared to the traditional rubber dam frame which eliminates the blockage of vision and nasal pathway. Ultimately, modified rubber dam frame provides better ease of operation for the operators and also pleasant treatment experience for pediatric patients.

Materials and Materials

The study revolved around operator's ease of use and patient's comfort while using the rubber dam isolation. Traditional Nygaard Ostby rubber dam frame and three-dimensional printed modified rubber dam frame were used. For the fabrication of modified rubber dam frame facial indices of children of age group 4 – 12 years were measured & based on the indices modified rubber dam frame was fabricated using prusa i3 Three-dimensional printing machine. 200 pediatric patients were taken of the above-mentioned age group as a sample population and they were divided into 2 groups comprising of 100 patients in each group. Group 1: Rubber dam isolation was done with traditional Nygaard Ostby rubber dam frame, Group 2: Rubber dam isolation was done with a modified Nygaard Ostby rubber dam frame. A structured questionnaire comprising 7 questions was given to the operators to evaluate the ease of use of both the rubber dam frames during isolation & to evaluate the patient's acceptability a Likert scale was used.

Questionnaire form for the operators:

1. Time is taken for placement of traditional/modified Nygard Ostby frame:

(a) less than 2 minutes

(b) 2 to 4 minutes

(c) 4 to 6 minutes

2. Difficulty faced during placement of traditional/modified Nygard Ostby frame:

(a) easy

(b) medium

(c) hard

3. Problem faced intraoperatively using the rubber dam isolation with the traditional/modified Nygard Ostby frame during placement:

(a) stable

(b) partially stable

(c) unstable

4. Need of assistance during placement of traditional/modified Nygard Ostby frame:

(a) yes

(b) no

(c) sometimes

5. Need of cutting of rubber dam sheet during placement of traditional/modified Nygard Ostby frame:

(a) yes

(b) no

(c) sometimes

6. Ease of removal of the traditional/modified Nygard Ostby frame after treatment:

(a) easy

(b) medium

(c) hard

7. Ease of operating:

(a) excellent

(b) good

(c) poor

Likert scale for the patients:

1 – Awful

2 – Not very good

3 – Okay

4 – Really good

5 – Fantastic

Results

A total of 200 pediatric patients and dentists were included in the study.

Majority of the operators (89%) in group 2 took less than 2 minutes for the placement of the rubber dam frame whereas in group 1 69% of the operators took less than 2 minutes and rest 31% took more time. According to the Pearson Chi-square test the *p*-value is <0.05 which was statistically significant. **(Table 1)**

93% of the operators in group 2 found that the modified rubber dam frame is easy to place compared to the 74% of operators in group 1 and the difference was statistically significant. **(Table 2)**

18% of the operators in group 2 encountered difficulty intraoperatively whereas 49% of operators in group 1 found problem while performing dental treatment using the traditional rubber dam frame and the difference was statistically significant. **(Table 2)**

On being asked regarding the need of assistance during the placement of the rubber dam frame, over 70% of operators in group 1 stated that they need assistance during placement whereas in group 2 67% of the operators stated that they need assistance during placement of the frame. There was statistically significant difference in both groups. **(Table 3)**

Over 90% of the operators required extra cutting of the sheet during placement with the traditional rubber dam frame because it blocks the vision and nasal passage of the patient. Since in group 2, the precut half size sheet was used only 30% of the operator. Only 30% of the operators required extra cutting of the sheet during placement. So based on the Pearson Chi-square test the difference was highly significant. **(Table 3)**

Based on the responses, operators in both groups found it easy to remove the frames after treatment. There was no significant difference. **(Table 4)**

Discussion

The dental environment in pediatric clinics presents many challenges for patients receiving dental care. Therefore, appropriate isolation is necessary to protect the operative area and ensure effective and safe treatment. Traditionally, the isolation of the tooth from the oral fluid during dental treatment has been considered an important part of the treatment process for optimal dental treatment. The main purpose of isolation is to control humidity, light and not harm the patient.[6,7]

In a study done by Lynch *et al* in 2007, they pointed out that rubber dam used by dental practitioners have a wide variety of advantages such as isolation of the operative area, provision of aspect field, improving infection control, preventing ingestion or aspiration of dental instruments, as well as protection and retraction of soft

tissue.[8,9,10] But still with all these advantages and the legal aspects favouring rubber dam, many practitioners still resisted its use in routine care. They claim that it is time consuming and uncomfortable for the patients. This was strongly supported in a study by Whitworth (2000) who founded that the majority of UK dentists never used the rubber dam for both restorative and endodontic procedures.[11]

Rubber dams have always been controversial. Its usefulness in dental treatment is almost indisputable in dental schools and many private hospitals, but it is rarely used by dentists. This disadvantage leads to the further development of traditional systems of isolation. Most innovations must make application and treatment easier to be accepted by dentists.[12,13] In addition to these innovations reviews are constantly needed on whether this development makes the use of rubber dam easier for dentists and increases the patient's comfort.[14 – 25]

The bulky design of the traditional Nygaard Ostby rubber dam frame may lead to blockage of vision and nasal passage which ultimately makes the child uncomfortable and uncooperative. Rubber dam isolation using the traditional Nygaard Ostby rubber dam frame required cutting of the rubber dam sheet. Thus to overcome all these problems an age-defined modified Nygaard Ostby rubber dam frame was made which came with advantages like no blockage of vision or the nasal passage, cost-effectiveness as it required only half a rubber dam sheet for each patient.

Based on this study modified Nygaard Ostby rubber dam frame had high patient acceptance compared to the traditional Nygaard Ostby rubber dam frame.

Conclusion

In conclusion, the efficacy of Traditional and Modified rubber dam frames in dental procedures has revealed compelling insights. The Modified rubber dam frame has proven itself to be a superior choice, demonstrating enhanced efficiency and operational simplicity when compared to the conventional rubber dam frame. efficiency and operational simplicity, thus making it a more favorable option for the dental practitioners. Furthermore, it has been shown to significantly improve patient's comfort throughout the treatment process when contrasted with the traditional frame. These findings hold significant practical relevance for dental professionals who aspire to streamline and enhance their rubber dam isolation procedures.

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Legend Tables

Table 1: Time taken for placement of the Traditional/Modified rubber dam frame

	Group 1 n (%)	Group 2 n (%)
Less than 2 minutes	63 (63%)	89 (89%)
2 to 4 minutes	23 (23%)	11 (11%)
Greater than 4 minutes	14 (14%)	0 (0%)
p value	0.001 $^{\Phi\mu}$	

Φ - *p* value (<0.05 is significant)

μ - Pearson Chi-Square test

Table 2: Difficulty faced during placement and Problem faced intraoperatively using the rubber dam isolation with the Traditional/Modified rubber dam frame

Difficulty faced during placement of the Traditional/Modified rubber dam frame			Problem faced intraoperatively using the rubber dam isolation with the Traditional/Modified rubber dam frame		
	Group 1 n (%)	Group 2 n (%)		Group 1 n (%)	Group 2 n (%)
Easy	74 (74%)	93 (93%)	Yes	49 (49%)	18 (18%)
Medium	23 (23%)	7 (7%)	No	37 (37%)	75 (75%)
Hard	3 (3%)	0 (0%)	Sometimes	14 (14%)	7 (7%)
p value	0.001 $^{\Phi\mu}$		0.072 $^{\Phi\mu}$		

Φ - *p* value (<0.05 is significant)

μ - Pearson Chi-Square test

Table 3: Need of assistance during placement of the Traditional/Modified rubber dam frame and Need of cutting of rubber dam sheet during placement of Traditional/Modified rubber dam frame

Need of assistance during placement of the Traditional/Modified rubber dam frame			Need of cutting of rubber dam sheet during placement of Traditional/Modified rubber dam frame		
	Group 1 n (%)	Group 2 n (%)		Group 1 n (%)	Group 2 n (%)
Yes	70 (70%)	67 (67%)	Yes	93 (93%)	30 (30%)
No	0 (0%)	0 (0%)	No	4 (4%)	59 (59%)
Sometimes	23 (23%)	30 (30%)	Sometimes	3 (3%)	11 (11%)
p value	0.072 $^{\Phi\mu}$		0.001 $^{\Phi\mu}$		

Φ - *p* value (<0.05 is significant)

μ - Pearson Chi-Square test

Table 4: Ease of removal of the Traditional/Modified rubber dam frame and Ease of operation

Ease of removal of the Traditional/Modified rubber dam frame			Ease of operation		
	Group 1 n (%)	Group 2 n (%)		Group 1 n (%)	Group 2 n (%)
Easy	86 (86%)	92 (92%)	Excellent	46 (46%)	24 (24%)
Medium	9 (9%)	8 (8%)	Good	50 (50%)	68 (68%)
Hard	5 (5%)	0 (0%)	Poor	14 (14%)	8 (8%)
p value	0.072 $^{\Phi\mu}$		0.001 $^{\Phi\mu}$		

Φ - *p* value (<0.05 is significant)

μ - Pearson Chi-Square test