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"Effectiveness and degree of acceptance of Hall technique as an alternative method for use of metal crowns in primary molars"

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ABSTRACT : Introduction: *The placement of metal crowns with the conventional technique can be stressful in small or anxious patients, which may require more time for preparation and increase the time of exposure to aerosols.* ***Objective:*** *To evaluate the effectiveness and degree of acceptance of the Hall technique as an alternative method for using metal crowns on primary molars.* ***Material and methods:*** *It was a clinical, observational, analytical study, with longitudinal measurement, with a sample of 27 primary molar crowns, which met the inclusion criteria, of patients aged 5 to 8 years.* ***Results:*** *27 crowns were placed on primary molars with the Hall technique, evaluated at 1, 3 and 6 months with 100% success. The degree of acceptance with the Hall Technique was observed, being 76.95% definitely positive, 15.38% positive and 7.70%. negative, according to the Frankl scale, clinical signs were observed at 1, 3, 6 months, with 92.6% asymptomatic at one month and 7.4% with inflammation and 100% asymptomatic at 6 months, with a statistically significant difference p=<0.135.* ***Conclusions:*** *An effectiveness and acceptance of the Hall technique was observed as an alternative method for metal crowns on primary molars.*

KEYWORDS: *Steel crowns, Hall technique, acceptance grade.*

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I. INTRODUCTION

At present, the etiopathogenesis of tooth decay and the evolution of Restoration materials and techniques has favored the expansion of Principles of the Minimum Invasion Dentistry (IMO).[1] The Atraumatic Restorative Treatment (TR) arises at the halves of the year of 1980, given the need to find a method to control and preserve the caried teeth in people of all ages and communities of very low resources where the only treatment to offer was the extractions.[2] It is focused on the handling of caries that saves fabric and use manual instruments to open the cavities of caries and eliminate demineralized caries, followed by a restoration. The technique does not require access to operated equipment.

The TR is done using glass ionomer since it releases fluoride, adheres to enamel and dentin remineralizing demineralized areas, is biocompatible with the pulp, is easy to manipulate. Fluoride release from the glass ionomer causes enamel and dentin to be more resistant to bacteria acids since it increases in acidic conditions, counteracting such acidity, increasing the pH of the external environment. This process is called damping and is clinically beneficial because it protects the tooth from more caries.[3-4]

It is classified as a minimal intervention approach both in relation to the patient and the tooth.[5] The lack of the use of anesthesia and rotary instruments makes this technique well accepted and less uncomfortable for patients compared to conventional restorative treatment. The operation time is lower and there is greater

cooperation from the patient, avoiding anxiety. Therefore, their acceptance in children and adolescents and their importance in behavioral adaptation deserve to be highlighted.[6]

Dental anxiety refers to a complicated behavior scheme, linked to a physiological trigger, originated as a reaction to cognitive, somatic and environmental stimuli, which emerge anterior and, in the course, the dental therapy in the patient without being identified. The main element lies in the temporal dimension between the behavior and the environment of dental therapy.[7]

Fear of pain goes hand in hand with developing dental anxiety, and it is common for the patient to try to avoid dental treatment.[8] Kent indicated that when an anxious patient is asked to recall the pain he or she has experienced, he or she overestimates it before and after the procedure.[9]

There are procedures that cause greater dental anxiety, because they involve vibratory sensations, sounds, unpleasant odors, and are more invasive in nature, such as caries removal with high-speed teeth, pulp treatments, extractions, application of anesthesia, and the preparation of crowns using traditional techniques.[10-12]

In their systematic review with meta-analysis, Monteiro G. et al. obtained the prevalence of dental anxiety by age group. They concluded that dental anxiety was significantly more prevalent in preschool and school-aged children with caries experience and in adolescent women.[13]

Placing stainless steel crowns is often challenging, as it requires patient cooperation, which is difficult to achieve in pediatric patients. To simplify the procedure and make it more patient-friendly, Dr. Norna Hall, a general dentist in Scotland, developed the Hall technique.[14]

The Hall technique is indicated in occlusal caries lesions I or II, occlusal lesions, cavitated lesions extended to the external third of the dentin, deep carious lesions without pulp involvement, if the patient cannot accept the partial caries removal technique or conventional restoration (anxious or uncooperative patients).[15]

Araujo, Innes et al., in 2020, measured the vertical occlusal dimension in children who received crowns using the Hall technique and concluded that it returned to its previous measurements within four weeks after treatment, with no difference between the initial measurements and those at four weeks after treatment.[16]

The Hall technique has been recognized as the “gold standard” for the management of carious primary molars without pulp involvement and is used and accepted worldwide.[17]

In 2019, Elamin, Abdelazeem, et al., compared the Hall technique with the traditional technique for placing metal crowns, supporting the 2014 trial conducted by Innes. They found that the survival rate of both the Hall technique and the traditional crown technique was high (over 90%) after two years, with no statistically significant differences. [18]

The Hall Technique is an alternative in this new era of COVID-19, avoiding the spread of aerosols. Although data supporting the use of the Hall Technique as a biological treatment option are scarce, its use is suggested as an option for the preparation required for metal crown restorations using conventional techniques, thus reducing aerosol-generating procedures.[19-23]

II. MATERIALS AND METHODS

The study was reviewed and approved by the Ethics Committee of the Faculty of Dentistry of the UAT, the clinical, observational, analytical study was initiated, with non-probability sampling by convenience consisting of 27 crowns of primary molars, of patients of both sexes, from 5 to 8 years old, with second degree caries, according to the selection criteria considered lesions code 5 (Severe Caries; detectable cavity with visible dentin> 0.5 mm up to half of the surface) of the International Caries Detection and Assessment System (ICDAS). After having been subject to review and determining that there is no ethical impediment that puts the integrity of the patients at risk, the study began by requesting the authorization of the parents or guardians of the children who participated in the work, which was recorded with the signing of the informed consent.

Once the patients were selected, a preoperative x-ray was taken with a digital x-ray #0 in the VistaScan program (Dürr Dental SE, Bietigheim-Bissingen, DEU). Once the x-ray was analyzed and a definitive diagnosis was obtained, the placement of a stainless-steel crown using the Hall Technique was indicated. Any residue of plaque, materia alba, or food present in the dental organ was removed; at this stage, the original technique was modified, and ART (Atraumatic Restorative Treatment) was performed, partially removing the softened tissue (infected dentin) using a Hu-Friedy 18 dentin tray (1.5 mm). This modification was performed on primary molars with extensive caries, and a biocompatible glass ionomer restorative cement (Fuji II GC®) was used.

Subsequently, orthodontic separator bands (Dentalastic®, blue) were placed to create spaces using two lengths of dental floss (GUM® Floss, 129M). These were inserted into the separator and pulled in opposite directions, stretching it and facilitating its entry firmly into the interproximal space (mesial and distal) until it crossed the contact point. Only half of the separator was required to pass the contact point, while the other half remained fixed at the level of the occlusal surface. The dental floss was removed, and a second appointment was scheduled for the patient 7 days later for crown adaptation. The orthodontic separators were removed from the

mesial and distal surfaces with the help of a dental explorer, the condition of the temporary glass ionomer restoration placed at the previous appointment was checked, and the occlusion was verified using a Hu-Friedy periodontal probe or a digital Vernier caliper to measure the preoperative vertical dimension from the lowest point of the gingiva of the lower canine to the highest point of the gingiva of the primary upper canine, to evaluate the degree of overbite after crown mounting, which measured 8mm.

To select the appropriate size of the stainless-steel crown (3M), the mesiodistal width of the tooth to be restored was measured with a periodontal probe, and the crown was measured to match the measurement of the primary molar. In some cases, it was necessary to trim the cervical margin of the crown and adjust it with cervical closure forceps for a better fit. The molar was washed with saline solution, dried, and then the glass ionomer cement (Fuji I GC®) was mixed with a cement spatula on a glass tile following the manufacturer's instructions. Using the same spatula, the crown was filled to two-thirds of its capacity, avoiding bubbles or voids. The patient was asked to bite on a cotton roll to seat the crown. Once the cement had set, excess glass ionomer was removed with dental floss in the interproximal area, an explorer, and gauze. As a final step, the occlusion was checked and the vertical dimension was measured with the help of the periodontal probe (Hu-Friedy), and the increase of 1 mm from the initial value was observed.

Follow-up radiographs were taken at 1, 3, and 6 months to assess the effectiveness of the Hall technique, and restoration of occlusion was observed at one month.

The child's behavior during the procedure was assessed using the Frankl Behavior Scale. This four-point scale, with Point 1 being "Definitely Negative," indicates the patient's rejection of treatment, loud screaming, fear, or any other evidence of negative behavior. Point 2 being "Negative," indicates the patient's difficulty accepting treatment, uncooperative, and expressing negative attitudes but not speaking out. Point 3 being "Positive," indicates the patient accepts treatment, shows a willingness to help and cooperatively follow instructions, but appears cautious. Point 4 being "Definitely Positive," indicates the patient's cooperative behavior throughout the treatment.

All information was recorded on a data collection form for each patient participating in the study. Tests were managed with an alpha value of 0.05 using IBM SPSS Statistics 21.

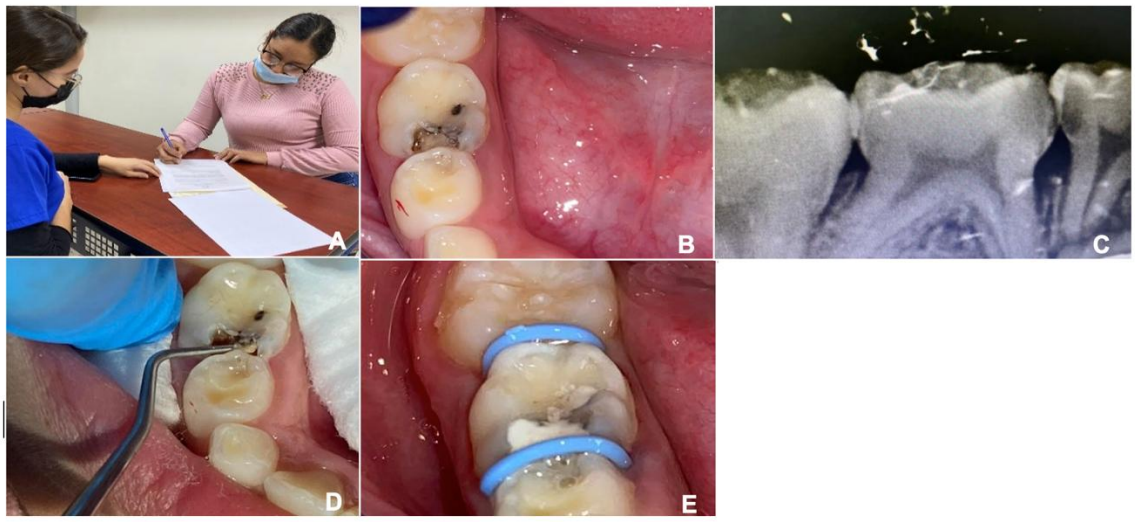

Fig.1 First appointment: A. Informed consent. B and C. Clinical and radiographic diagnosis. D. Cavity cleaning. E. Cavity sealing with glass ionomer and placement of separating bands.

Fig.2 Second appointment: A. Separating ligatures present. B. Removal of separating ligatures. C. Initial occlusovertical dimension (8 mm). D. Measurement of the mesiodistal width of the molar with a Hu-Friedy periodontal probe. E. Measurement of the mesiodistal width of the metal crown with a Hu-Friedy periodontal probe. F. Crown try-in. G. Crown 2/3 filled with type I glass ionomer. H. Crown seating. I. Removal of excess cement with dental floss. J. Crown cemented. K. Final radiograph. L. Occlusovertical dimension after placement.

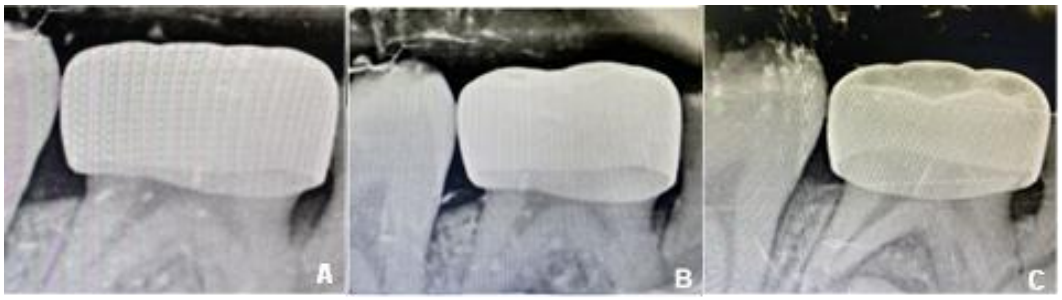

Fig.3 Follow-up. A. First month. B. Third month. C. Sixth month.

Fig.4 Restoration of occlusion at one month.

III. RESULTS

The study consisted of 27 primary molar crowns with second-degree caries lesions from patients aged 5 to 8 years who met the selection criteria. Patients were randomly assigned to the Pediatric Dentistry Clinic of the School of Dentistry at the Autonomous University of Tamaulipas. The degree of acceptance of the Hall technique was analyzed according to the Frankl behavioral scale, resulting in a definitively positive acceptance rate of 76.9% of patients, a positive rate of 15.4%, and a negative rate of 7.7%.

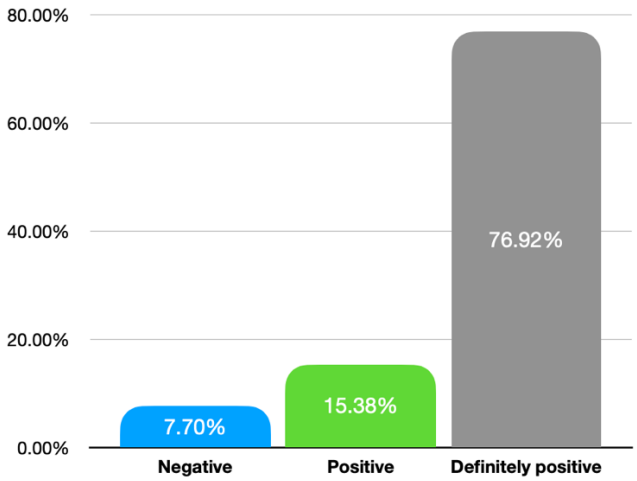

Fig.5 Percentage distribution of the degree of acceptance of the Hall technique.

The effectiveness of the technique was also evaluated, with success reported in 100% of the patients studied. Table 1.

Table 1.- Frequency distribution and percentage of the effectiveness variable.

Effectiveness	n	%
Success	27	100%
Major Failures	0	0%
Minor Failures	0	0%
Total	27	100%

Subsequently, at 3 and 6 months, the absence of clinical signs was observed in 100% of the patients in the study. Table 2.

Table 2. Frequency distribution and percentage of clinical signs.

Clinical signs	1 month		3 months		6 months		*P value*
	n	%	n	%	n	%	
Asymptomatic	25	92.6%	27	100.0%	27	100.0%	0.135
Inflammation	2	7.4%	0	0.0%	0	0.0%	
Symptomatic	0	0.0%	0	0.0%	0	0.0%	
Total	27	100.0%	27	100.0%	27	100.0%	

The percentage distribution of the number of primary molars in the study is shown, with the upper right first molar accounting for 18.5% and the upper right first and second molars with identical results at 7.4%, these being the least restored.

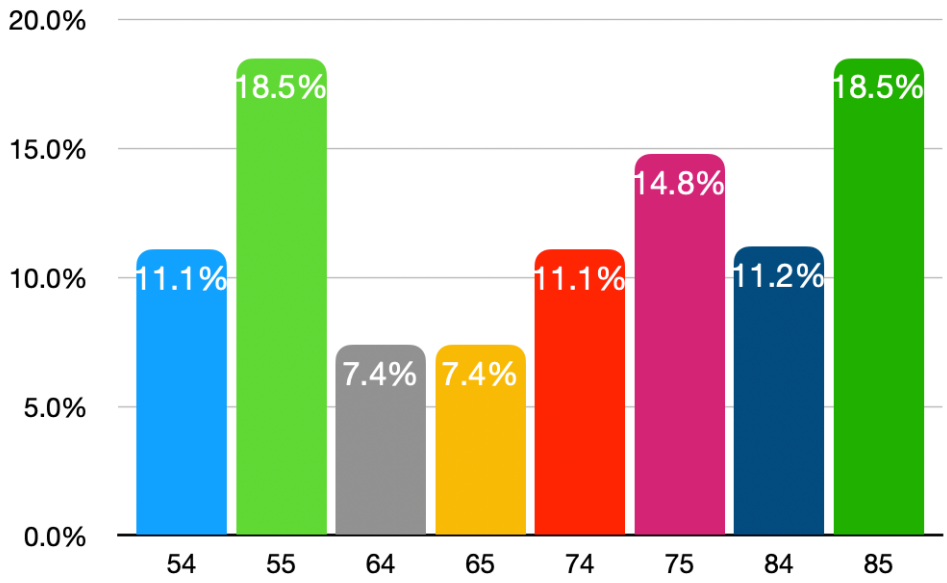

Fig. 6 Percentage distribution of the number of primary molars.

IV. DISCUSSION

Xiaoli Gao et al[24] in the dental consultation, the pediatric patient has with him not only the oral discomfort, but also an emotional burden of lived experiences or of his close environment, since he is afraid, anxiety and worry in the face of painful situations, since they are being exposed to new experiences which are unknown to him. We agree with Xialoi et al., since we observed that some of the newly admitted patients presented anxiety, which was transmitted by their parents, in addition to some negative experience, they rejected dental care. We conclude that they may come predisposed and / or with an emotional disturbance.

Gao S. et al[12] mentions that, in the dental environment, there are procedures that cause greater dental anxiety, such as vibratory sensations, sounds, and are invasive in nature, such as caries removal with high-speed pieces, pulp treatments, extractions, application of anesthesia, and the preparation of crowns with a traditional technique. We observed in patients where the Hall technique was not performed, that the use of the handpiece, noise, water, or invasive treatments and placement of anesthesia, provoked negative behavior and caused dental anxiety.

Innes et al[14] measured the vertical occlusal dimension in children who received Hall technique crowns and concluded that it returned to its previous measurements within four weeks after treatment, with no difference between the initial measurements and those at four weeks after treatment. The vertical dimension in the children

in this study returned to normal approximately 4 weeks after crown placement, with no complaints. It was not possible to evaluate this variable because the patients were unable to attend consultations every week.

Ludwig et al[25] conducted a retrospective chart review of pediatric patients at a dental practice in which they used the Hall technique as an alternative treatment for crown placement instead of the traditional technique. Ninety-seven percent of crowns placed using the Hall technique were successful within 37 months, and 94% of crowns placed using the traditional technique over 33 months were successful. We evaluated the effectiveness of the Hall technique, reporting a success rate in 100% of all crowns placed (27 crowns) in the patients studied at 1, 3, and 6 months.

Badar et al[26] demonstrated in their systematic review that the Hall Technique has greater clinical success and significantly outperformed conventional restorations. We agree, that the Hall Technique has a high clinical success rate (100% in our study).

Midani[27] found that the advantages of the Hall Technique make it suitable for use in young children who are anxious or afraid of needles, or as a means to improve the child's cooperation, gain their trust, and obtain parental acceptance. This technique was applied to patients aged 5 to 8 years. Their degree of acceptance of the Hall Technique was assessed according to the Frankl Behavior Scale, resulting in a definitively positive acceptance rate of 76.9%, corresponding to 10 of the patients, a positive acceptance rate of 15.4%, and a negative acceptance rate of 7.7%.

V. CONCLUSION

The effectiveness of the Hall technique in the restoration of 27 primary molars was evaluated at 1, 3, and 6 months. 100% of the patients were successful, with no major or minor defects found during the six-month study period.

The degree of acceptance of the Hall technique in 13 pediatric patients was observed, with 76.95% definitively positive, 15.38% positive, and 7.70% negative, according to the Frankl scale.

A 92.6% clinical success rate was recorded with the Hall technique, with 25 molars in the primary dentition reporting asymptomatic during the six-month study period. Only two molars presented gingival inflammation at the first month (7.4%). This was associated with poor patient hygiene.

It was observed that with the Hall technique, pediatric patients were cooperative (92.3%) and only 7.7% uncooperative.

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