SUCCESS RATE OF THE HALL TECHNIQUE AND THE CONVENTIONAL METHOD IN THE TREATMENT OF CLASS II CARIOUS LESIONS ON PRIMARY MOLARS

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ABSTRACT

INTRODUCTION: Some of the filling materials are extremely ineffective cases of secondary caries as they leave the tooth surface unprotected against cariogenic conditions in the oral cavity. A new approach for treatment of primary molars with preformed metal crowns (PMCs) is implemented known as Hall Technique. PMCs provide excellent sealing in primary molars arresting the progression of the carious process.

AIM: The aim of this article is to do a comparative assessment of the received results when restoring approximal dentin carious lesions with glass ionomer cement (GIC) and Hall crowns in primary and early mixed dentition.

MATERIALS AND METHODS: For a 2-year period object of clinical observation were 100 teeth with approximal dentin carious lesions on primary molars in children at 5-7 years of age from Varna. Fifty of them were restored with GIC, and the other 50 were sealed with PMCs using the Hall technique. The progression of the carious lesion and the failure of the restoration were examined.

RESULT: The major failures with the Hall technique after 2-year follow-up accounted for only 2%, and the minor ones were 4%. For the conventional methods with GIC as filling material, they were 12% and 48%, respectively.

CONCLUSION: The average duration of PMCs restorations using the Hall technique is very high. They may be an appropriate option for restoration and treatment of the carious process on primary molars, especially for class II carious lesions. After the follow-up period we can conclude that the Hall technique has advantage over the conventional methods of treatment with GICs.

Keywords: Hall technique, major and minor failures, GICs

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INTRODUCTION

Young patients deserve the best dental treatment, preventive or operative, which the dental practitioners can provide to preserve their dentition healthy in future (1). It is very important to point out that the choice of treatment method, material and restoration technique of primary teeth depends on the individual caries risk of the patient, the period of development of the dentition and the pulp condition

(2). The aim of every restoration technique of the dentition is: 1) to restore the destroyed hard tooth tissues from the dental caries, 2) to prevent and maintain the integrity of hard tooth tissues and the pulp, protecting it from inflammation and pain symptoms, 3) to maintain adequate function, 4) to provide good aesthetics (when it is possible), 5) to facilitate oral hygiene, 6) to preserve the integrity of the dental arch and to provide proper conditions and space for the developing permanent dentition (3,4). Some of the filling materials are extremely ineffective concerning the secondary caries as they leave the tooth surface unprotected against the cariogenic conditions in the oral cavity (5,6). For example, preformed metal crowns (PMCs) cover the whole surface including the risk areas and greatly decrease the risk of secondary caries (7,8). Another major reason for the failure of some filling materials is their falling out or endodontic complications (6,9,10). The main focus is on the approximal carious lesions, where the restoration often experiences failures. In occlusal caries almost every filling material is successful (11). Glass ionomer cements (GICs) achieve satisfying results only for small, single-surface lesions (12). Their mechanical resistance in cases with extensive lesions is unsatisfying in the long term (13). One of the positives of GICs is that they establish a chemical bond with the hard tooth tissues. Although there is a wide choice of GICs on the market, the indications for their use are limited (14).

A new approach for treatment of primary molars with PMCs was implemented by Evans et al. (15) known as Hall technique. The crowns are cemented without preliminary excavation of the caries or preparation of the tooth and without local anesthesia (4,16). For the restoration of occlusal carious lesions adhesive materials, like GICs, may provide reliable sealing (3,17-20). This may be a very difficult task for cases with severely destroyed teeth – class II carious lesions (11,20-23). PMCs provide excellent sealing in primary molars arresting the progression of the carious process.

AIM

The aim of this article is to perform a comparative assessment of the received results when restoring approximal dentin carious lesions with GIC and Hall crowns in primary and early mixed dentition.

MATERIALS AND METHODS

For a 2-year period the object of clinical observation were 100 teeth with approximal dentin carious lesions on primary molars in children at 5-7 years of age from Varna, who visited the Faculty of Dental Medicine – Varna and the University Medical Dental Center. Fifty of them were restored with GIC, and the other 50 were sealed with PMCs using the Hall technique. The progression of the carious lesion and the failure of the restoration (partial or full loss of the restoration, secondary caries, recurrent caries, abrasion, symptoms of pulpal inflammation, fistula/abscess) were examined.

RESULTS

Minor failures with GICs were the most common because of bad mechanical properties when restoring class II carious lesions. Partial or full loss of the restoration was observed, followed by secondary caries around the filling. Minor failures allow the tooth to be restored again without any endodontic treatment or extraction. With Hall crowns the most common minor failures were recurrent caries in the marginal area in cases with badly fitted crowns. The visible apical progression of the carious process is visible on X-ray (Fig. 1). Other minor failures were partial or full falling out of the crown, as well as crown perforation, which can easily be replaced by a new one.

Fig. 1. Minor failure with apical progression of the carious process

Table 1 shows the results related to the failures of treatment with GICs and PMCs. With GIC restorations there were two registered minor failures on the 6th month after the application. They consisted

of partial or full loss of the restoration. In PMCs the first minor failure was reported 1 year after the application. It was characterized progression of the carious lesion visible only on X-ray in the apical direction of the crown brim. The reason reported was that the crown brim did not fully cover the carious lesion in the cervical area (close to the enamel-cement border). There no symptoms of pain in the registered minor failures. After the first year the minor failures for GIC cases were 9 in total, and for PMCs – 1. After a 2-year period the minor failures, which were reported for GICs, increased their number greatly – 13 in total. In PMCs one more case with recurrent caries below the crown brim in the apical direction was registered after the 24th month.

Table 2 shows the major failures registered for GIC – 6 in total for the entire follow-up period. PMCs showed only one major failure for the same follow-up period. On the 6th month a tooth restored by the conventional method presented with pain symptoms, related to irreversible pulpitis. On the 12th month 2

major failures on teeth restored with GIC were reported – one with pain symptoms and one with fistula. After the second year three more major failures were registered – two of the teeth were with fistula and one with pulpal inflammation. The only major failure for the teeth treated by the Hall technique was registered on the 24th month. There were no pain symptoms, but fistula was observed.

In both cases with minor failures treated with PMC, the treatment was conducted using the original Hall technique. The case with major failure was also registered on a tooth which was treated only by the Hall technique. Statistically significant difference ($p < 0.05$; $p = 0.0163$) was reported on the received results depending on if the Hall technique was used separately or combined with the ART technique – a modified Hall technique.

This method for non-operative treatment of the carious process has good results and reliable prophylaxis in regard to the complications of the carious process.

Table 1. Minor failures according to Innes reported after 6th, 12th and 24th month for GIC and PMC

Criteria for minor failures	GIC		PMC		GIC		PMC		GIC		PMC	
	6 month				12 month				24 month			
Loss of restoration	n=1	2%	n=0	0%	n=2	4%	n=0	0%	n=4	8%	n=0	0%
Fracture of the restoration	n=1	2%	n=0	0%	n=3	6%	n=0	0%	n=4	8%	n=0	0%
Abrasion	n=0	0%	n=0	0%	n=2	4%	n=0	0%	n=2	4%	n=0	0%
Secondary caries	n=0	0%	n=0	0%	n=2	4%	n=0	0%	n=3	6%	n=0	0%
Recurrent caries	n=0	0%	n=0	0%	n=0	0%	n=1	2%	n=0	0%	n=1	2%
Total	n=2	4%	n=0	0%	n=9	18%	n=1	2%	n=13	26%	n=1	2%
	$\chi^2=3.131$ df=5 P = 0.6798				$\chi^2=20.000$ df=5 P =0.0012				$\chi^2=28.000$ df=5 P=0.0000			

Table 2. Major failures according to Innes reported on 6th, 12th and 24th month for GIC and PMC

Criteria for major failures	GIC			PMC	GIC		PMC		GIC		PMC	
	6 month				12 month				24 month			
Symptoms for pulpal inflammation	n=1	2%	n=0	0%	n=1	2%	n=0	0%	n=1	2%	n=0	0%
Fistula/Abscess	n=0	0%	n=0	0%	n=1	2%	n=0	0%	n=2	4%	n=1	2%
Total	n=1	2%	n=0	0%	n=2	4%	n=0	0%	n=3	6%	n=1	2%
	$\chi^2=2.400$ df=2 P=0.3012				$\chi^2=9.210$ df=2 P=0.0161				$\chi^2=0.889$, df=2 P=0.6412			

The total number of the major failures in GICs was 12% compared with PMCs where the major failures were only 2%. Minor failures were observed in 48% of the GIC fillings and 4% of PMCs (Fig. 2). Statistically significant difference in the rate of minor failures at the first and second year after the treatment with GIC and PMCs ($p < 0.05$) was reported (Table 1). For major failures, statistically significant difference was reported only at the first year after the treatment (Table 2).

Fig. 2. Major and minor failures in restorations on primary molars with PMC and GIC.

DISCUSSION

The received results are similar to those in many scientific researches. In the study of Innes and Evans (16) 132 pairs of teeth were examined. These were teeth restored applying the Hall technique and control group with teeth restored using GIC. The follow-up period was 36 months. In this period the registered cases were as follows: 57 cases with total with minor failures for GIC fillings and barely 6 for PMCs. Twenty-six of the GIC fillings were fully lost and only one lost a crown. In 23 clinical cases of teeth restored with GIC secondary caries was observed and only one case with the same type of caries around poorly seated preformed crown. In cases with teeth restored with PMCs less functional abrasion was observed compared to the one with GIC. There were 5 abraded GICs and 1 PMC with the other technique. For GICs reported were 3 cases of progression of the caries process under the filling, which was visible only in control radiograph. There were two cases reported for PMCs. Out of all GIC restorations 56% experienced minor failures in a 3-year period while for the preformed metal crowns this number was 7%. The

major failures which were reported by Innes et al. (16) consisted of 19 affecting the teeth restored with GIC and 3 were observed in those with the Hall technique. Out of a total of 19 teeth with GIC fillings, 3 were reported having symptoms related with irreversible pulpitis, 12 with abscess or fistula, two teeth with severe loss of hard tooth tissues which could not be treated, 1 of the teeth underwent pulp therapy, but there were no results reported and there was 1 tooth with registered internal root resorption. For the teeth treated by the Hall technique, out of 3 major failures in total one had pain symptoms related to irreversible pulpitis and 2 teeth were reported having fistula or abscess.

In 2016, Hesse et al. (24) compared the ART technique to the Hall technique for caries treatment. The follow-up period was 3 years and the failures were also divided into major and minor – borrowed from the Innes and Evans survey. The teeth treated by the ART technique showed 50% to 75% rate success for a 2-year follow-up period. In 3 years this rate dropped to 20%. The Hall technique was reported to have 98% success rate after 1 year and 95% - after 4 years.

In 2014 Santamaria et al. (25) compared the success rate of the Hall technique, non-operative treatment of the carious lesion and the conventional method of treatment. The failures were divided into major and minor. Authors reported 11 minor failures in the conventional method of treatment after the first year, which equaled 20% of all cases. For the Hall technique the authors registered only one tooth with minor failure, or 2%. In 9% (5 teeth) of the cases using the conventional method there were major failures, while for the Hall technique there were no reported cases for major failures for a 1-year follow-up period.

In 2008 Rosenblatt (26) PMCs applied by the Hall technique with conventional filling materials. The results which were reported were divided into minor and major failures. The minor failures represented 46% (57 teeth) of the total number of the control teeth treated by the conventional methods. The reported minor failures for the Hall technique represented 5% (6 teeth) from the total number of teeth treated with this technique. The major failures were 15% for the conventional method and 2% for the Hall

technique. The results were reported after a 2-year follow-up period. For a 9-year follow-up period, on the 5th year these values were 17% and 2%, respectively, and after the 9th year – 17% for the conventional and 4% for the Hall technique.

In 2005 Roberts, Attari and Scheriff (27) compared the durability of GIC and PMCs. They reported results for class I and class II carious lesions. The authors received results for 1088 GIC restorations and 1107 PMCs. They reported 51 unsuccessful GICs in class II lesions, one of which was with pulpal inflammation. A total of 30 unsuccessful cases were described for PMCs, 9 of which were with total loss of the crown and 21 with functional abrasion.

CONCLUSION

In the group of teeth restored with PMCs the total number of failures was very little. The registered recurrent caries in the marginal area are observed under poorly seated crowns. In primary molars restored with PMCs no resorption of the interdental bone on the control X-rays is reported. The average duration of PMC restorations is very high. They may be an appropriate option for restoration and treatment of the carious process on primary molars, especially for class II carious lesions. After the follow-up period we can conclude that the Hall technique has advantage over the conventional methods of treatment.

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