

# Effectiveness of Sealants Treatment in Permanent Molars: A Longitudinal Study

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## ABSTRACT

**Background:** Our study gives a clear result about sealants treatment in preventing dental caries manifestation and reducing its prevalence in children aged 6–11 years old.

**Aim and objective:** This study aims to compare and evaluate the progress of dental caries in the first and second permanent molars and also to evaluate, within a period of 24 months, the clinical effects of dental sealants, used in the treatment of occlusive cavities, among children 6–11 years old.

**Materials and methods:** Participants: The overall sample was composed of 120 children, to whom we randomly chose 480 posterior teeth, which were divided into two groups. Intervention: The first group was the control group with 240 untreated teeth, while the second group had an equal number of teeth, which underwent the sealant treatment. The study participants were evaluated within the periods 0, 6, 12, 18, and 24 months. The study participants were checked every 6 months. Basic design: This observational, analytical, and descriptive research was designed as a longitudinal study. The study started in January 2019 and ended in January 2020. The study was conducted in five dental clinics in the city of Vlore, Albania.

**Results:** After 24 months of observation, we noticed that the number of dental caries in the untreated group is three times higher than the number of dental caries in the treated group. In the group of teeth treated with sealant, 189 (78.8%) teeth remained unaffected by dental caries. The present study showed that there is a significant correlation between period and caries manifestation ( $p < 0.05$ ). It also proved that sealant treatment is an important measure and it is highly significant in the caries reduction ( $p = 0.000$ ).

**Conclusion:** This study proved that sealant treatment is highly successful in reducing dental caries. In the future, it is worthwhile to go further in this research.

**Clinical significance:** Dental caries is a problem in children aged 6–11 years old and not only. That is why this study recommends that sealants treatment should be used to prevent and reduce the prevalence of dental caries.

**Keywords:** Dental caries, First and second permanent molar, Preventive dentistry, Sealant treatment.

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## INTRODUCTION

In our survey, we have taken into consideration the progress of dental caries in the first and second permanent molars for the period of 24 months between children 6 years and 11 years old.

Based on the National Health and Nutrition Examination Survey 2011–2012, showed that 21% of the children, aged 6–11 years old, were diagnosed with dental caries in their permanent teeth. While comparing these results to the same survey conducted in the period 1999–2004, a decline in the prevalence of caries in primary teeth and a minimal decrease in the caries percentage were noticed.<sup>1,2</sup>

About 90% of dental caries in permanent posterior teeth was found in pit and fissure.<sup>3</sup>

Fissures and holes, where organic waste and oral bacteria collect, are considered to be ideal places for caries development.<sup>4–7</sup>

Nowadays, data show that sealants are effective in children with a high risk of caries.<sup>8–11</sup> Sealant application is a preventive conservative approach in caries reduction. It fills the teeth surface, as well as prevents the further destruction of the teeth.<sup>12</sup>

According to Warren et al., there are two categories of patients: young and old.<sup>13</sup> Young patients have a high predisposition to dental caries and it is exactly this category that benefits more from dental sealants. The other category is composed of older patients that are considered candidates for sealants, because of their reduced flow of saliva. The objective of sealants treatment is

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to prevent food collection and to create a geometric form of the teeth fissure.<sup>13</sup>

Most of the fissures have a degree of macro-tension, which makes place for the food waste to enter into the teeth. That is why the creation of micromechanics retention is required. Another reason why this retention is important is that sealants may be insufficient to reach the deeper parts of the teeth.<sup>14</sup>

Sealant is not very resistant to friction, it is flattened from the use of abrasive foods, but, the main areas of the tooth remain isolated good, which proves the positive continuous benefits of sealant treatment.<sup>14</sup>

The lack of knowledge on indications and effectiveness of sealants and the clinical experience of the dentists have a call into question the benefits of sealants treatment. These led dentists to suspend sealants treatment utilization, which brought in incomplete treatments.<sup>9,10,15</sup>

The main principle for sealant success is the right retention. The material of the sealants should be fluent to fill in the fissures and holes and to have sustainability to the fractures to resist the chewing forces and friction.<sup>14</sup>

The sealant must be well fixed not to create points of pre-contact or to interfere with the biting method. The success depends on the strength of the superficial layer of the sealant, and if this layer is intact there should be no reason for caries progress.<sup>15</sup>

Various studies showed that sealants may be used effectively in children, as long as the sealants are well preserved.<sup>16,17</sup>

Droz et al. pointed out that sealants treatment can reduce dental caries up to nine times. This fact along with the sealants' cost-effectiveness are some of the potential advantages of sealants treatment, which justify their use in the prevention of dental caries.<sup>18</sup>

The purpose of this study is to evaluate the reduction of dental caries within a period of 0–24 months and the clinical effects of dental sealants, used in the treatment of occlusive cavities, among children 6–11 years old.

## MATERIALS AND METHODS

The present clinical study is a longitudinal study conducted among children aged 6–11 years old. The overall sample was composed of 120 children, to whom we randomly chose 480 posterior teeth, which were divided into two groups:

Group I = 240 untreated teeth considered as the control group.

Group II = 240 teeth underwent the sealant treatment.

The study participants were checked every 6 months. The study started in January 2019 and ended in January 2020. The study was conducted in five dental clinics in the city of Vlora, Albania.

The teeth of the first group did not undergo any treatment. They were just controlled by the dentists according to the periods chosen by this research, whereas the second group was treated with (UltraSeal XT™ hydro South Jordan, Utah, USA) according to the consecutive protocol. Acid etching was performed using 37% phosphoric acid gel (3M™ Scotchbond™ Universal Etchant gel, Minnesota, USA), which was applied to the occlusal surface covering the teeth for 60 seconds.

To remove the acid etching completely, the teeth were rinsed with air–water spray for 15–20 seconds while the air-drying was done for 5 seconds with a three-way syringe. The sealant was applied for 10 seconds, after that, it was polymerized for 20–40 seconds. The dentists assured good retention and polymerization of the sealant before the children leaving. The treatment progress would be checked in the following visit.

Our study was conducted in accordance with the Helsinki declaration.<sup>19</sup> Based on the Declaration of Helsinki issued by the World Medical Association, our research, which was on human participants, was clearly formulated in experimental protocols. In our study, we anticipated the benefits and the potential risks to our sample and after that, we took the consent of the children's parents. Permissions were obtained in the written form, which allowed us to perform the observations. Parents had the right to withdraw their children at any time.

The inclusion criterion was the age range 6–11 years old. The exclusion criteria were children must not have orthodontic brackets.

Children with enamel hypoplasia, dental fluorosis, and children who refused dental treatment were excluded from the study. Another limitation of the present study is the sample size, which was not large enough to generalize the results. The study had no dropouts. Six doctors participated in our study, four dentists and two assistants, who registered the children.

## Study Design

This observational, analytical, and descriptive research was designed as a longitudinal study. The sample was not kept under hospital observation. After doing the treatment children were free to go. As we said the participants were selected through simple randomization and were invited to take part in the research. The inclusion criteria were in the age range of 6–11 years old. Informed written consent was obtained from all parents of the participants. This study was approved by the University of Vlora, Albania.

## Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics 23.0. Data were analyzed by *post hoc* LSD test in analysis of variance (ANOVA). The significance level ( $\alpha$ ) was set at 0.05 with a confidence interval (CI) of 95%.

## RESULTS

The data analysis showed that in the control group, there was an increment of dental caries (64.2%) in the first and second molars, within the period 0–24 months. Based on the results, for the same period, in the group treated with sealant, we noticed that there was a decrease of dental caries (21.2%). At the end of the study, in the treated group, there were 51 carious teeth, whereas, in the untreated group, there were 154. Based on the results, the number of carious teeth in the untreated group is three times higher than the number of carious teeth in the treated group (Table 1).

The distribution of caries in the control group within the period 0–24 months. The present study noticed that dental caries, in the control group, incremented to 154 (64.2%) after 24 months, while 86 (35.8%) teeth resulted without caries (Fig. 1).

The distribution of caries in the treated group within the period 0–24 months. In the treated group, 189 (78.8%) teeth remained unaffected by caries and 51 (21.2%) teeth were with caries (Fig. 2).

The present study proved that there is a significant correlation between time and caries manifestation ( $p < 0.05$ ). In other words, time is a factor that increases the presence of caries (Table 2).

The treatment with sealant is an important preventive measure and very highly significant in caries reduction ( $p = 0.000$ ) (Table 3).

Sealants application showed a high quality in the decrease of caries incidence with (78.8%) in the treatment of first and second permanent molars.

**Table 1:** The increment of dental caries in the untreated and treated groups in the period of 0–24 months

| Time period | Caries (untreated group) (%) | Caries (treated group) (%) |
|-------------|------------------------------|----------------------------|
| 0 month     | 16 (6.67)                    | 12 (5)                     |
| 6 months    | 24 (10)                      | 6 (2.5)                    |
| 12 months   | 28 (11.67)                   | 9 (3.75)                   |
| 18 months   | 37 (15.4)                    | 11 (4.58)                  |
| 24 months   | 49 (20.4)                    | 13 (5.41)                  |
|             | Total = 154 (64.2)           | Total = 51 (21.2)          |

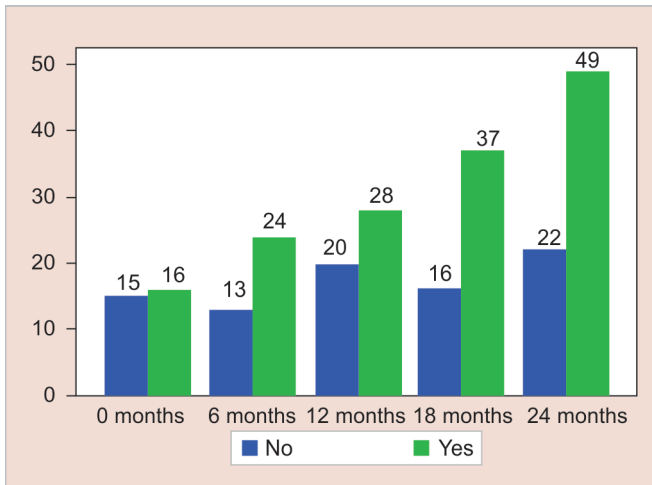


Fig. 1: The distribution of caries in the control group within the period 0–24 months

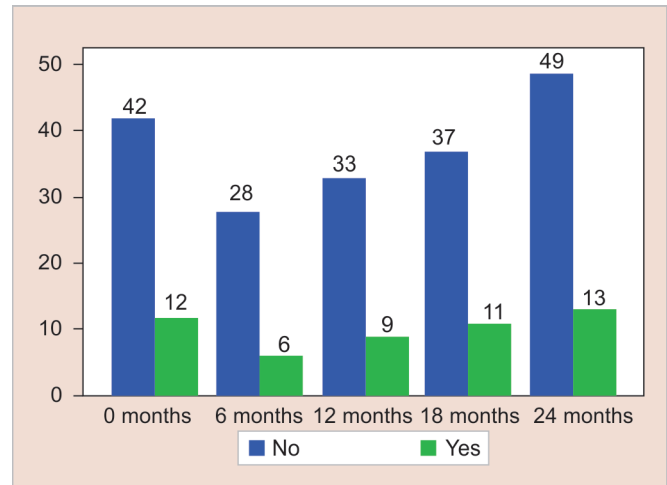


Fig. 2: The distribution of caries in the treated group within the period 0–24 months

Table 2: The correlation between time period 0–24 months and caries manifestation

| Time period | gL | F     | CI 95%      | p    |
|-------------|----|-------|-------------|------|
| 0–24 months | 1  | 4.208 | 0.026–0.551 | 0.03 |

Table 3: The influence of sealant treatment in caries reduction

| Sealant treatment | gL | t    | F     | p     |
|-------------------|----|------|-------|-------|
| 1                 |    | 5.83 | 110.8 | 0.000 |

**DISCUSSION**

Pit and fissure sealants were found to be an outstanding element to preventive strategies of oral healthcare in the decrease of occlusal caries on its initiation and progression.<sup>20</sup>

Properties of the pit and fissure sealants such as surface tension and viscosity are the most important factors that influence the penetration of the sealants.<sup>21</sup> The use of sealants prevents the colonization of the bacteria and also inhibits the penetration of fermentable food waste remaining in the pits and fissures.<sup>22</sup>

According to Joseph and Donnell, pits and fissures' morphology causes them to be eight times more vulnerable to dental caries.<sup>23</sup> Similar results were obtained by Mathewson and Primosch, who proved that the high incidence rate of pit and fissure caries is mainly due to its complex morphology which makes it an ideal site for the preservation of bacteria and residual food.<sup>24</sup>

Caries involving the occlusal surface of molars constitutes 52.7–66.3% of all carious lesions.<sup>25</sup> Sanders et al. confirmed a strong correlation between the sealant treatment and the absence of caries.<sup>22</sup>

Cueto and Buonocore, in their study, proved that after the teeth were treated with sealant for 1 year, dental caries percentages declined to 86.3%. The results above are similar to the ones obtained in the present study.<sup>26</sup>

In our survey, we have taken into consideration the sealants treatment as a prophylaxis study. This research chose to investigate 480 teeth from 120 children, where 240 teeth were treated with sealant, to generate precise conclusions on the effectiveness of

sealants treatment. The results of this study showed that children treated with sealants developed caries 21.3%, while in the control group caries developed in the values 64.2%.

Similar studies about the effectiveness of sealants on reducing dental caries in the recesses and grooves of the posterior teeth emphasized that sealants should be used as dental caries preventive measure.<sup>10,11</sup>

In the United States, from 2011 to 2012, it was reported that 31.4% of 6- to 8-year-old children had a fissure sealant.<sup>2</sup> In Germany, a study among 8- to 12-year-old children showed that 55.6% of children had at least one fissure sealant applied.<sup>27</sup>

According to a study conducted on adolescents aged 12–18 years old in Portugal reported that 59% of the participants had the presence of at least one fissure sealant on FPMs.<sup>28</sup>

In contrast, a very low fissure sealants' prevalence was noted in 12- to 15-year-old Greek adolescents (8%).<sup>29</sup> In the Middle East, in Saudi Arabia, it was found that only 9% of adolescents had a minimum of one permanent molar sealed.<sup>30</sup>

To protect the teeth from dental caries, the sealing of pits and fissures can generally be recommended. Feigal and Donly claimed that as the emergence of caries has changed in the last decades, not only teeth in eruption should be sealed.<sup>31</sup>

The World Health Organization considers the pit and fissure sealants as the primary preventive and the most effective measure, to ensure the complete protection and the preservation of teeth from the carious phenomenon.<sup>32,33</sup> This finding is similar to the claim of the present study and its contributions in the field of dentistry.

Sealants are a good preventive measure and they can inhibit the progression of carious lesions. They have important characteristics, such as the bio-compatibility and ease of use, which make these materials ideal products.<sup>34,35</sup>

According to the evidence-based guidelines of the American Dental Association (ADA), in collaboration with the American Academy of Paediatric Dentistry (AAPD), the use of sealants is recommended more than the fluoride varnish utilization or using no sealant at all.<sup>36,37</sup>

Sealants are considered to be more cost-effective if they are used to children at high risks of caries development or with teeth surfaces susceptible to caries.<sup>38</sup>

Based on the results of the present study, the number of carious teeth in the control group was three times higher than the number of carious teeth in the treated group. There is a significant decrease in dental caries if the teeth are sealed with sealants.

Within the limitations of our study, we suggest that sealants are considered to be a good preventive treatment, to decrease caries incidence and protect the teeth.

Another study conducted by Koulourides et al. claimed that if sealants are lost during patient visits they should be replaced, as sealants provide prevention of dental caries.<sup>39</sup>

According to the present study, sealing the teeth with sealants is considered to be highly effective in the prevention of caries in the first and the second permanent molars.

It is necessary to discuss the limitations of this research. We should have included a larger sample of children in this study, and also the period should have been longer. Another limitation that we can mention is the children's age range that this study took into consideration, which was 6–11 years old.

We highly recommend the use of pit and fissure sealants as a beneficial treatment. The main recommendations are that sealing pits and fissures of permanent posterior teeth is safe and effective, both in protecting and preserving the teeth. Dentists should therefore be encouraged to apply sealants.

Based on our results, we concluded that the sealants treatment reduces and prevents dental caries.

## CONCLUSION

This study proved that sealant treatment is highly successful in reducing dental caries. In the future, it is worthwhile to go further in this research.

## CLINICAL SIGNIFICANCE

Dental caries is a problem in children aged 6–11 years old and not only. That is why this study recommends that sealants treatment should be used to prevent and reduce the prevalence of dental caries.

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