



Restorative Cost Savings Related to Dental Sealants in Alabama Medicaid Children

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Abstract

Purpose: Since properly placed and retained sealants can reduce the incidence of caries lesions and save subsequent restorative costs, the purpose of this study was to compare the subsequent restorative cost in a group of predominantly African American Medicaid children who received prior sealants to that of a group of children who did not receive sealants.

Methods: Dental claims of 2 cohorts of 5- to 7-year-old children who were continuously enrolled in Alabama Medicaid from 1990 to 1997 (N=9,549) and who either did or did not receive sealants were analyzed using basic descriptive statistics, chi-square and *t* tests, and regression analysis. The subsequent restorative care costs related to 1-surface posterior amalgam or resin restorations were evaluated in relation to sealant status and selected independent variables.

Results: Only 10% of the children with at least 1 prior sealant claim obtained subsequent 1-surface posterior amalgam or resin restorations. This proportion was 33% among children without a prior sealant claim (OR=4.2, 95% CI=3.6-4.9). On average, total Medicaid reimbursement per child for sealants, plus subsequent restorative care was \$56 in the sealant group compared to \$72 for subsequent care alone in the nonsealant group. This difference was independent of the child's race, gender, or age.

Conclusions: As expected, children who do not receive sealants are more likely to obtain subsequent restorative care and cost more money to the health care system. However, the modest sealant-related subsequent restorative cost savings observed among Alabama Medicaid children may be an underestimate of the real cost-benefits of sealants. (*Pediatr Dent.* 2003;25:572-576)

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The Council on Dental Materials of the American Dental Association approved sealants as a safe and an effective means to prevent pit and fissure caries lesions in 1976.¹ Since then, the United States has set specific objectives in providing sealants to children. Healthy People 2000 and 2010 objectives call for a 50% prevalence of sealants on at least 1 permanent molar by the age of 14 years.² According to NHANES III Phase I data, between 1988-1991, nearly 20% of 5- to 17-year-old US children had at least 1 sealed permanent tooth, and approximately 1% of 2- to 11-year-old children had at least 1 sealed pri-

mary tooth.³ As more children receive sealants today than ever before, the cost effectiveness of sealants has become an important consideration.

Numerous investigators have evaluated the effectiveness of sealants using various settings such as dental practices,⁴ community⁵ and clinic-based programs,⁶ national⁷ and state surveys,^{8,9} state Medicaid programs,^{10,11} and other settings.¹²⁻¹⁵ Properly placed and retained sealants not only decrease the number of cultivable microorganisms in carious dentin and arrest the progression of the carious lesions,^{16,17} but also reduce the restorative care expenditure.¹¹ While some have shown that

Table 1. Demographic Distribution of Alabama Children Continuously Enrolled in Medicaid from 1990-1997 With at Least 1 Dental Claim

Variable	Nonsealant Group N (%)	Sealant group N (%)
Gender:*		
Female	2,615 (46%)	1,081 (52%)
Male	3,016 (54%)	996 (48%)
Race:*		
White	1,213 (22%)	573 (28%)
African American	4,377 (78%)	1,490 (72%)
Other	41 (1%)	14 (1%)
Total	5,631	2,077

*Significant difference between groups, $P < .0001$ (chi-square test).

initially sound tooth surfaces do not benefit greatly from the application of sealants,¹⁸ or that sealant placement may provide only a nominal additional preventive effect,¹⁹ others have shown that sealant placement is associated with expenditure savings to Medicaid¹¹ and sealants are more effective if placed in children who have high rather than low caries risk.¹³ Since low-income minorities are known to be at high risk, the authors evaluated the cost effectiveness of sealants provided to a group of predominantly African American Alabama Medicaid children.

Previously, the authors studied the prevalence of sealants and the barriers in meeting the year 2010 sealant objectives in Alabama Medicaid recipients using 1990-1997 Medicaid claims.¹⁰ The purpose of the current study was to use the same data to evaluate the subsequent restorative costs related to 1-surface posterior amalgam or resin restorations in children with or without prior sealants as a measure of the cost effectiveness of sealants. The authors' null hypothesis was that there is no difference in subsequent restorative costs between children with or without prior sealants.

Methods

Two primary databases related to Alabama Medicaid claims were used in the analysis. The first database (eligibility database) contained the demographic characteristics of the Medicaid-eligible subjects. The second database contained information related to procedures performed, the claims submitted, and the amounts reimbursed by Medicaid (claims database). A detailed description of data and the analytic methods are discussed elsewhere.^{10,20} The University of Alabama at Birmingham Institutional Review Board for Human Use reviewed and approved the study protocol.

Alabama Medicaid children who were 5 to 7 years of age by

October 1, 1990, and who were continuously enrolled in Medicaid from October 1, 1989 to September 30, 1998 (1990-1997 fiscal years), were eligible for the study. Among those who were eligible, the authors identified 2 subcohorts. The first subcohort consisted of children who had at least 1 sealant claim during the study period (sealant group) and the second consisted of those who had no sealant claims (nonsealant group). The authors then retrospectively followed each child within each subcohort to see if they had any subsequent claims related to restorative care using American Dental Association procedure codes D2140 (permanent 1-surface amalgam) and D2385 (permanent 1-surface posterior resin). Total and per-subject cost related to subsequent restorative care based on the amount claimed by the practitioner and the amount reimbursed by Medicaid were calculated.

Using the regression analysis, the authors evaluated the demographic factors in relation to sealant utilization and subsequent restorative care costs to address the hypothesis that the restorative cost savings related to sealants are independent of the child's age, race, gender, or the availability of a participating provider within the county of residence.

Results

A total of 9,549 children were 5 to 7 years of age in 1990 and also remained continuously enrolled in Medicaid through 1997. Of these, 7,708 children had at least 1 dental claim (for any procedure) during the study period. Among those, 2,077 had at least 1 sealant claim and 5,631 had no sealant claims. The gender and race distribution of the sealant and nonsealant groups are provided in Table 1. There were statistically significant racial and gender differences between the 2 groups. The sealant use among whites was 29%, which is statistically significantly higher ($P < .05$) than that of African American (20%) and others (20%).

Approximately 10% of the sealant group had subsequent restorative care in terms of posterior 1-surface amalgam or resin restorations, and about 33% of the nonsealant group had similar services (Table 2). In other words, children who did not have a sealant claim during the study period were 4 times more likely to have subsequent restorative care compared to those who had at least 1 sealant claim (OR=4.2; 95% CI=3.6-4.9). The total charge for those who used both sealant and restorative treatment was \$94.10 (sealant charge=\$34.02; restorative cost charge=\$60.08) with a Medicaid reimbursement of \$55.50 per person (sealant reimbursement=\$20.03; restorative

Table 2. Restorative Costs for Children With or Without Prior Sealant Claims: Alabama Medicaid Data 1990-1997

Group	N	Subsequent restorative care: N (%)	Total cost (\$)	
			Reimbursed	Cost/subject (\$)
Sealant	2,077	219 (11%)	\$12,150	\$55.50
Nonsealant	5,631	1,879 (33%)	\$135,061.20	\$71.90

Table 3. Factors Associated With Subsequent Restorative Care Cost (Reimbursed): Alabama Medicaid Data 1990-1997—Regression Model

Variable*	Beta	±SE	P
No prior sealant claim	55.3	9.1	<.0001
Prior sealant claim	18.8	8.8	.03
Gender	3.7	1.7	.03
Race	5.4	8.6	.01
Age at entry	4.9	1.5	.0006
Provider availability	20.3	16	.20

*Age is used as a continuous variable while the reference group for gender was male, race was African American, and provider availability was nonavailability of a provider.

cost reimbursement=\$35.47). For those who did not receive sealants, the cost of subsequent restorative care alone as claimed was \$115.10 with a Medicaid reimbursement of \$71.90 per person. This resulted in about \$16 (unadjusted for inflation) of savings to Medicaid in subsequent restorative costs per child had they received prior sealants.

The regression model indicated that the nonsealant group had a significantly higher subsequent restorative care cost ($\beta=55.3$; $SE=9.1$) compared to the sealant group ($\beta=18.8$; $SE=8.8$) which remained significant after controlling for race, gender, age at entry, and the availability of a provider within the county of residence (Table 3). Race, gender, and the age at entry also had independent effects on the subsequent restorative care cost.

Discussion

Alabama Medicaid started paying for sealants in 1989. By evaluating Alabama Medicaid claims from October 1989 to September 1998, the authors could address the issues related to sealant use among the Medicaid recipients during the first 8 years of the program. To arrive at a meaningful conclusion in relation to subsequent restorative costs and cost savings due to sealants, the authors need to assume that these children did not receive any dental care during the observation period from providers who were not participating in Medicaid. Based on the authors' experience, the authors judge this to be a reasonable assumption. However, if they did receive care from non-Medicaid providers and the authors, in fact, misclassified their sealant experience or the future restorative care (over or under estimate), this misclassification may have been applicable to both sealant and nonsealant groups (random misclassification), thus biasing the authors' estimates toward the null values.

The data indicated that the nonsealant group was 4 times more likely to have subsequent restorative care and cost more money to Medicaid in relation to future 1-surface posterior amalgam or resin restorations compared to those who had at least 1 sealant claim. However, due to the nature of Alabama Medicaid data, it was not possible

to identify the teeth that were involved in sealant or subsequent care claims. Therefore, it was difficult to assess if the subsequent care evaluated was in fact related only to the teeth that were or could normally be sealed. Even though the authors focused on posterior 1-surface restorations (most likely to be related to surfaces that are normally sealed), it is likely that at least a part of the subsequent care was related to the teeth or surfaces that were not sealed.

Furthermore, the "sealant" group may not necessarily have had all 4 permanent molars sealed. Recommended teeth for sealant application among the Medicaid population are first permanent molars for children aged 6 through 8 and permanent second molars for children ages 11 through 13 (first priority) and premolars in high-risk children and primary molars (second priority).²¹ The guidelines for Alabama Medicaid, however, were much more limiting than these recommendations during the study period, as these children were only eligible for sealant of permanent first molars, further biasing the authors' estimates toward the null value.

The ideal method of obtaining a valid estimate of the cost savings related to sealants is by prospectively following up a group of children with and without sealants. This is difficult due to ethical and other logistical considerations. The population-based large retrospective cohort study the authors conducted is certainly a viable alternative to the above and allows addressing the cost-effectiveness of sealants within the limitations discussed earlier.

Despite these shortcomings and, therefore, the potential to underestimate the benefits of sealants (ie, some teeth in the "sealant group" that were subsequently restored never had sealants in the first place), the sealant group experienced a modest but significant reduction in subsequent restorative costs. If it is assumed that 50% of Alabama children between 5 to 7 years of age receive sealants (Healthy People 2010 objective), the cost savings in terms of subsequent restorative care for Medicaid would be around \$820,000 per 100,000 children. Since this is an underestimation, the real cost savings could be even larger. Furthermore, most subsequent restorations may need replacements as they have limited longevity, adding to the future costs required to maintain the form and function of the tooth.

For example, Mjor and colleagues have shown that the median age of amalgam restorations in adults was 11 years and that of resin-based composite restorations was 8 years.²² The median age of failed conventional glass ionomer restorations in adults was 4 years and for resin-modified glass ionomer was 2 years. In adolescents, the median longevity of failed amalgam restorations was 5 years and that of composite restorations was 3 years, while both types of glass ionomers had a median longevity of 2 years. In this regard, properly and timely placed sealants that will reduce the need for subsequent restorations and re-restorations would further add to the cost savings of sealants. As indicated in the

authors' regression model, the subsequent cost reduction in the sealant group was independent of the child's race, gender, or age, or the availability of a provider.

In general, these findings are consistent with the literature. Weintraub et al, have shown that identifying children with prior restorations and sealing the remaining molars is a cost-saving measure.¹⁵ Weintraub et al, also performed a retrospective cohort analysis of children enrolled in the North Carolina Medicaid program and compared the likelihood of restorative treatments and associated cumulative Medicaid expenditures for teeth with or without dental sealants. Based on a cohort of 15,438 children from 1985 to 1992, they conducted regression analyses for outcomes (caries lesion-related services involving the occlusal surface [CRSOs] of permanent first molars) and cumulative expenditures, controlling for characteristics of the child, the treating dentist, and the child's county of residence. Overall, 23% of children received at least 1 sealant and 33% received at least 1 CRSO. Sealants were effective in preventing CRSOs, although the degree of effectiveness was highest for children with the greater levels of CRSOs before sealant placement. Estimated cumulative Medicaid expenditures indicated expenditure savings from sealants within 2 years of application for children with 2 or more prior CRSOs.¹¹

In a school based setting in Australia,²³ Morgan et al, assessed the cost effectiveness of a 3-year pit and fissure dental sealant and fluoride mouthrinsing program in 2 nonfluoridated regions in Victoria. This setting is not comparable to the United States setting. Nevertheless, their analysis—based on a community intervention in 5 schools comparing an intervention group receiving the pit and fissure dental sealant, a weekly fluoride mouthrinsing, and an annual oral hygiene education session with a control group receiving oral hygiene education—only indicated that the intervention group avoided 1.22 DMFS over 3 years with a reasonable cost saving.²³

The total and per-subject cost difference the authors observed is consistent with the fact that restorations cost more than sealants. According to Kuthy, the mean charge for a 1-surface restoration is more than double the mean sealant charge.²⁴ The reason why the per-child cost in the nonsealant group is less than double the cost in the sealant group in the authors' study may be due to the fact that some teeth that were sealed also needed subsequent restorative care.

The observed savings in terms of future restorative care costs were significant but modest in this predominantly African-American group. Even if the observed cost saving is an underestimation, this group also tends to experience racial and other barriers in meeting the national sealant objectives.¹⁰ In light of these challenges, additional innovative preventive measures should be utilized in reducing these disparities. For example, it has been shown that simple measures such as the regular use of Xylitol chewing gum over the course of 2 or 3 school years is as effective as occlusal sealants.²⁵ Such interventions obviously need careful evaluation and additional research.

Even with the limitations of the database, there was a modest but significant cost saving in terms of posterior 1-surface amalgam or resin restorations in children who had prior sealants. These cost savings were independent of the race, gender, age of the child, and the availability of a provider in the county of subject's residence.

Given that there are numerous issues that lead to low utilization of oral health services among Medicaid children, and there are considerable racial disparities in sealant use, attempts should be made first to increase the number of dentists who work with high-risk groups and then to enhance the use of sealants and other preventive measures.

Conclusions

Children who receive sealants are more likely to require less restorative treatment costing less than those who do not receive sealants.

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ABSTRACT OF THE SCIENTIFIC LITERATURE



IMPACTED MAXILLARY CANINES

The purpose of this study was to evaluate the long-term results of orthodontic treatment of impacted maxillary canines in children. A total of 61 children (23 boys and 38 girls) who received orthodontic treatment for impacted canines were evaluated for esthetics, occlusal function, periodontal health and tooth vitality a mean of 3.5 years after treatment. Four of the 61 patients were not satisfied with the esthetic result, while orthodontists found 56% of the cases esthetically acceptable on clinical evaluation. No differences were found between the treated canines and normally erupted canines with respect to plaque index, gingival index, or width of attached gingiva, while differences in pocket depth and canine rise occlusion were present. The majority of treated children were satisfied with the esthetic result, while orthodontists determined that more than half of the cases were clinically and esthetically acceptable.

Comments: Orthodontic treatment of impacted maxillary canines yields reasonably good results. This paper suggests that most patients are satisfied with treatment results, while orthodontists are more critical in assessing the clinical and esthetic results. **LDK**

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D'Amico RM, Bjerklin K, Kurol J, Falahat B. Long-term results of orthodontic treatment of impacted maxillary canines. *Angle Orthod*. 2003;73:231-238.

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