

Comparison of Total Salivary Antioxidant Capacity of Children with and without Severe Early Childhood Caries before and after Complete Dental Rehabilitation

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ABSTRACT

Introduction: Early childhood caries (ECC) is the most chronic disease affecting children all over the world. Children often complain of pain and need complete rehabilitation, which is often done under general anesthesia due to extensive treatment and behavioral problems that are often encountered. The present study was undertaken to evaluate the total salivary antioxidant capacity of children with severe ECC (S-ECC) before and after complete dental rehabilitation and compare it with caries-free children.

Materials and methods: Salivary samples were obtained from 30 children aged 3–5 years and diagnosed with S-ECC, along with 30 age and sex-matched controls. Complete dental rehabilitation under general anesthesia was performed on the children with S-ECC, and follow-up salivary samples were obtained after 3 and 6 months postoperatively. Total salivary antioxidant capacity was measured using a commercially available Oxygen Radical Absorbance Antioxidant Assay measurement kit. At baseline, children with S-ECC had higher total antioxidant capacity (TAC) compared to the controls.

Results: A significant difference in total salivary antioxidant capacity between both groups was seen at baseline. At 3 months following, the total salivary antioxidant capacity of children treated for S-ECC was slightly higher than controls but had significantly reduced compared to baseline. At 6 months, there was no significant difference between both groups.

Conclusion: Within the limitations of our study, it can be concluded that the total salivary antioxidant capacity associated with children suffering from S-ECC is reduced after complete rehabilitation.

Keywords: Complete dental rehabilitation, Early childhood caries, General anesthesia, Salivary antioxidant capacity.

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INTRODUCTION

Early childhood caries (ECC) is the occurrence of a decayed, missing, or filled tooth in children below 71 months. ECC is the highest reported chronic infection affecting children globally and influences the lives of children and their families in a negative way.¹ A more destructive form of the disease is known as S-ECC, which consists of more teeth. Despite being preventable, ECC is prevalent due to its multifactorial etiology, which can be attributed to a sugar-rich diet, poor oral hygiene practices, and low socioeconomic status.²

The body counteracts the caries process to a degree by an instinctive sheltering process which is innate to saliva, and its physicochemical properties have been linked to caries. Saliva is an amalgamated liquid consisting of various organic molecules and compounds that protect the body from oxidative stress caused by various free radicals.³ This is possible due to the salivary antioxidant system consisting of various enzymes such as peroxidase, catalase, superoxide dismutase, and glutathione peroxidase, which protects the body from various redox hemostasis.⁴

Total antioxidant capacity (TAC) refers to the measure of free radicals scavenged by a test solution and is used as a marker for the antioxidant capacity of saliva. Various studies have shown that children with ECC have increased TAC. Although it has been understood that TAC increases due to inflammation, it is not clear whether it is due to the microorganisms in the carious process or the comprehensive body's compensation for the ailment.^{4–6}

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Children with ECC are preschoolers who require multiple dental treatments, which require good cooperation and coping abilities to the clinical scenarios in the dental office. To provide high quality treatment, children with ECC and S-ECC are treated under general anesthesia which is completed in a single appointment.⁶

Various studies have been done over the years to evaluate the antioxidant capacity of children with ECC.^{4,5,7} However, research on long-term follow-up after complete rehabilitation is limited.⁶ Hence,

this investigation was undertaken to evaluate the effect of full mouth rehabilitation on those suffering from ECC under general anesthesia.

MATERIALS AND METHODS

The present study was undertaken after obtaining ethical approval from the Institutional Review Board (IHEC/SDC/FACULTY/21/PEDO/187). The intervention was explained to elucidated in English, and the local language to parents of patients, and only those willing to participate were recruited for the study. All parents were provided with opportunities to clarify their doubts before the initiation of the research.

Sample power was calculated using the G*Power sample power calculator (version 3.1.9.6 for Mac OS X 13, Heinrich Heine Universität Düsseldorf, Düsseldorf, Germany). An analysis of a previously published study was used to determine the sample size which gave a set of 20 participants to each group. Additional 10 participants were added to each group to account for future attrition as the investigation proceeded.

Thirty children who were 3–5 years old, who had received fitness from the anesthetist and pediatrician, and who were scheduled for full mouth rehabilitation under general anesthesia for S-ECC were included in the interventional group. Children who did not belong to the 3–5 years age group, those who required retreatment for relapse of ECC or S-ECC, medically compromised children, and those who were suffering from other long-term medical problems. The controls consisted of children free from dental caries who matched both the age and gender of the participants of the study group.

Participants were invited early in the morning to collect saliva based on the methodology described by Alanazi et al.⁶ All participants refrained from following routine oral hygiene instructions on the day of saliva collection and children who required management for ECC under general anesthesia were fasting as per protocols. The collected sample was stored in cold storage at -112°F . The samples were collected at baseline, 3 and 6 months.

The collected saliva samples were analyzed for TAC by using a commercially available Oxygen Radical Absorbance Antioxidant assay measurement kit (Zen-Bio ORACTM, United Kingdom) and analyzed using a multi-detection microplate reader (FLx800™, BioTek® US, Vermont, United States of America).

RESULTS

This trial consisted of 60 children of which 30 children were diagnosed with S-ECC while the remaining 30 were caries-free and served as controls who consented to participate in the trial. All 60 patients completed the trial without loss to follow-up. The demographics and baseline data are depicted in Table 1.

At baseline, the TAC scores were found to have significantly different between both groups ($p < 0.001$). Participants who underwent treatment had elevated values when compared with the controls. At the 3-month follow-up, it was found that TAC scores were reduced after treatment for children who had S-ECC. There was a significant difference ($p < 0.05$) in TAC scores. At 6 months

no significant differences were seen in TAC scores between both groups (Tables 2 and 3). When the TAC scores were compared for children with S-ECC, it was seen that there was a significant (p -value < 0.05) in the scores between baseline and 3 months. No significant difference was seen in TAC scores between 3 and 6 months. Comparison of TAC scores at baseline and 6 months were found to be statistically significant (Table 4).

DISCUSSION

The management of ECC and S-ECC is complex due to the extent and presentation of the disease. Since the children who are affected are young and lack the cognitive capability to cooperate well for treatment, they are treated under general anesthesia which is an accepted behavior management technique for preschoolers with ECC and S-ECC for the provision of safe and successful dental treatment.^{1,2,6}

The body has various means and processes which help to reduce oxidative stress in an individual, the first mediators for dental caries usually being the antioxidants that are present in saliva.⁸ The antioxidant mechanisms become active as soon as inflammation begins to develop in the body.^{6,8} Both ECC and S-ECC are specific patterns of decay that are seen in children younger than 6 years and are considered to be inflammatory mechanisms that would eventually result in an increased oxidative response in the mouth.^{6,9}

The comparison of TAC between the participants illustrated an increase in the antioxidant capacity of saliva in children who were affected by S-ECC. The increased antioxidant activity which was seen in children who required intervention could be probably the response to ECC or S-ECC.^{3,5} ECC is considered to be an infectious test to the body which results in elevated TAC for those suffering from it.⁶

Comprehensive dental therapy for pediatric patients with ECC and S-ECC is now considered a standard protocol for intervening in the disease process. The present study population consisted of children who required treatment under general anesthesia, which would allow the entire treatment to be done in a single appointment and also result in the absolute eradication of dental caries in one sitting. This would also initiate the resolution of inflammation which was present due to the disease from the same day, unlike appointments in the dental office where treatments would be completed on various days depending upon the appointments and cooperation of the child who was receiving treatment.^{4,6}

In the present study, TAC values were found to decrease significantly from the baseline to the last follow-up visit. This can be attributed to the complete removal of the nidus of infection associated with S-ECC after full mouth rehabilitation under general anesthesia and to the improvement of oral hygiene and modifications in dietary habits.¹⁰ At 6 months, it was seen that the values between the controls and the test group children did not show any major variation. This may suggest that the decrease in TAC in the test group could be due to the absolute removal of infection and the healing process has been completed.¹¹

Table 1: Demographic details

Parameter	Study group	Control group	<i>p</i>
Age (years)	4.2 ± 1.3	4.3 ± 1.2	0.712
Sex	Male-16 (53.3%); female-19 (46.7%)	Male-15 (50%); female-15 (50%)	0.795
DMFT	11.1 ± 2.1	0	<0.001

Table 2: Comparison of TAC scores between the control group and the S-ECC group

		95% confidence limit for median			Significance
		Median	Lower	Upper	
Baseline	Control	1.48	1.19	1.65	<0.001
	S-ECC	2.73	2.41	2.97	
3 months	Control	1.51	1.21	1.63	<0.05
	S-ECC	1.98	1.82	2.06	
6 months	Control	1.49	1.24	1.59	0.691
	S-ECC	1.52	1.26	1.68	

Table 3: Progression of TAC values in control and S-ECC groups

		95% confidence limit for median			Significance
		Median	Lower	Upper	
Control	Baseline	1.48	1.19	1.65	0.736
	3 months	1.51	1.21	1.63	
	6 months	1.49	1.24	1.59	
S-ECC	Control	2.73	2.41	2.97	<0.05
	3 months	1.98	1.82	2.06	
	6 months	1.52	1.26	1.68	

Table 4: Comparison of TAC scores before and after dental treatment in the S-ECC group

Time of measurement		N	Significance
Baseline to 3 months	Baseline TAC greater than posttreatment	27	<0.001
	Posttreatment TAC greater than baseline	3	
	No change in TAC		
3–6 months	3 months TAC greater than 6 months	24	0.032
	6 months TAC greater than 3 months	3	
	No change in TAC	3	
Baseline to 6 months	Baseline TAC greater than posttreatment	28	<0.001
	Posttreatment TAC greater than baseline	1	
	No change in TAC	1	

The control group showed no significant changes throughout the study period. As all children were caries-free, there was no infection associated with them. The results of our study are similar to that of AlAnazi et al.⁶ who found that there was a significant reduction in TAC of children suffering from S-ECC after complete rehabilitation. The results however contradict the findings of a study conducted recently that investigated the TAC of children with dental abscesses before and after treatment which showed no significant differences.¹¹ This could be due to the reason that only teeth with abscesses were treated and comprehensive treatment was not done.¹²

The study had a few limitations. The small sample size cannot be used to establish the findings of the present study. The follow-up period was limited to 6 months. Recent studies have shown that nearly 40% of children treated for ECC often return for retreatment.¹³ Hence long-term follow-up may give varied results. Long-term studies would help to give a better understanding of TAC and its changes with follow-up.

CONCLUSION

The TAC of children with S-ECC reduced significantly after complete rehabilitation within 6 months. Full mouth rehabilitation under

general anesthesia is an effective way to treat children with S-ECC and helps in the removal of the infection.

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