

# Oral Health-related Quality of Life of Children with Early Childhood Caries before and after Receiving Complete Oral Rehabilitation under General Anesthesia

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## ABSTRACT

**Introduction:** Early childhood caries (ECC) significantly affects the quality of life of children due to recurrent pain, infection, and other associated problems.

**Aim and objective:** To assess the change in oral health-related quality of life of children aged <5 years undergoing complete oral rehabilitation under general anesthesia.

**Materials and methods:** A total of 50 healthy children affected with ECC were enrolled for the present study. Oral health-related quality of life (OHRQoL) of every child was assessed by interviewing the mothers using a prevalidated Early Childhood Oral Health Impact Scale (ECOHIS) questionnaire one day prior to the treatment appointment and comparing the scores with those at 1 and 3 months post-treatment to evaluate the changes in the OHRQoL, if any and assess the stability of the changes.

**Results:** The results revealed a statistically significant reduction in Quality of Life (QoL) scores of all the domains and total ECOHIS scores between baseline and 1 month, and baseline and 3 months.

**Conclusion:** The oral health-related quality of life showed a significant improvement after complete oral rehabilitation under general anesthesia and the improvement persisted beyond the immediate post-treatment period.

**Keywords:** Complete oral rehabilitation, Early childhood caries (ECC), Early childhood oral health impact scale (ECOHIS), General anesthesia, Oral health-related quality of life (OHRQoL).

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## INTRODUCTION

Early childhood caries (ECC) remains one of the commonest health problems among preschool children.<sup>1</sup> In severe form, it adversely affects the quality of life in young children due to recurrent pain (19.8%), infection, abscesses, malnutrition, gastrointestinal problems, and significant loss of school hours (3%).<sup>2</sup> Prevention of its progression and restoration of the already damaged tooth structure while relieving the associated clinical symptoms is an important step towards improving the quality of life of these children. The young uncooperative children are usually managed by pharmacological behavior management techniques due to the limited cognitive ability of these children to comply with routine non-pharmacological behavior management techniques. Single visit treatment under general anesthesia (GA) poses minimal discomfort to a child and decreases the physical and mental stress of both the patient and the operator though sometimes a few patients undergo transient confusion or memory loss, dizziness, urinary retention, nausea, vomiting, chills, and sore throat.<sup>3,4</sup>

The positive outcome of complete oral rehabilitation under GA can be assessed by measuring the change in QoL of children with ECC for which numerous scales are available. A significant improvement in QoL of children with ECC, treated under GA has been reported from various parts of the world but its sustainability over a prolonged period after treatment has not been explored enough.<sup>5-7</sup>

In India, the prevalence of ECC is 49.6% but the complete oral rehabilitation of young children using pharmacological behavior

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management techniques especially GA is not common in our country.<sup>8</sup> Consequentially, the data on the OHRQoL in young uncooperative Indian children aged less than 5 years using the ECOHIS questionnaire is sparse. The present study was planned to evaluate the impact of complete oral rehabilitation under GA on OHRQoL of Indian children aged less than 5 years of age.

## MATERIAL AND METHODS

### Study Design

The present investigation was a single arm, clinical trial among children undergoing complete oral rehabilitation under general anesthesia in the Unit of Pedodontics and Preventive Dentistry, Oral Health Sciences Centre, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh. The study was approved by the Institutional Ethics Committee, PGIMER, Chandigarh (Ref. No: NK/4637/MDS/247).

### Sample Size Estimation

The sample size was estimated based on the study by Jankauskienė et al. who had longitudinally assessed the impact of dental treatment carried out under general anesthesia on the quality of life among Lithuanian children using ECOHIS questionnaire.<sup>1</sup> Keeping the power of the study as 0.9 and  $\alpha$  as 0.05, a sample size of 44 was estimated. Further taking into account 10% attrition, the final sample size was rounded off to 50.

### Study Population

Young, uncooperative children less than 5 years of age with Frankel behavior rating of 1 (exhibiting definitely negative attitude towards treatment, vehement crying, frightened, or any other obvious signs of extreme negativism) and 2 (reluctant to receive treatment, uncooperative, some signs of negative attitude but not pronounced),<sup>9</sup> with extensive dental caries and falling under American Society of Anesthesiologists (ASA) category I (completely healthy fit patient)<sup>10</sup> were included. Children with a known history of allergy especially to anesthetic drugs, children with special health care needs as well as those with medical problems affecting their daily activities were not included in the study.

### Preanesthetic Evaluation

The need for dental treatment under GA was explained to the parents and they were informed about the potential complications of the procedure. Those willing to proceed with the treatment were sent for pre-anesthetic evaluation. The pre-anesthetic assessment was carried out by a qualified anesthetist who assessed the child's fitness for GA administration based on the child's medical history and a thorough physical examination. The comprehensive treatment procedure was then explained to the parents in their local language before obtaining informed consent. The selected children were scheduled for treatment under GA. The parents were given instructions regarding nil per oral (NPO), as per the ASA guidelines<sup>10</sup> and the same was reinforced telephonically one day prior to the scheduled appointment.

### Project Implementation Plan (Fig. 1)

The clinical examination was carried out at baseline, 1 month post-treatment, and 3 months post-treatment designated as T0, T1, and T2, respectively.

### Proforma and Oral Health-related Quality of Life

For the present study, a proforma was specially designed, which comprised three sections. The first section: constituted the demographic details including the child's gender and age (in months), parent's education, parent's occupation, family income, household characteristics, and socioeconomic status, assessed through the modified Kuppaswamy scale (2018).<sup>11</sup> The second section: recorded data related to dental treatment, duration is

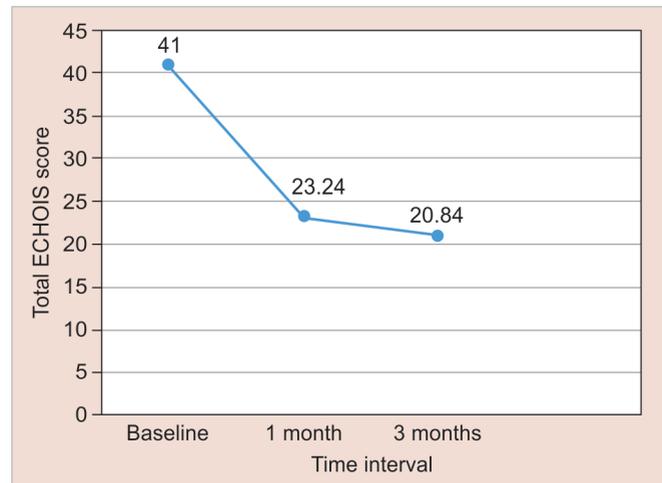


Fig. 1: Graph of methodology

taken for treatment under GA and oral health parameters viz. dental caries using international caries detection and assessment system (ICDAS),<sup>12</sup> dental plaque using Silness–Loe plaque index (PI) and gingival health using Silness–Loe gingival index (GI).<sup>13</sup> In the third section: the OHRQoL was assessed using ECOHIS<sup>14</sup> which uses parental scorings of 13 items divided into two broad sections viz. the child impact section (CIS) and the family impact section (FIS). The CIS comprises four domains: child symptoms (1 item), child functions (4 items), child psychology (2 items), and child self-image and social interaction (2 items). The FIS comprises two domains: parental distress (2 items) and family function (2 items). Each question is related to the frequency of an oral health-related problem and is scored on a scale from 0 to 5 as follows: never (score 0), hardly ever (score 1), occasionally (score 2), often (score 3), very often (score 4) and don't know (score 5).<sup>14</sup> This study proforma was initially validated in 10 subjects that satisfied the inclusion criteria of the study, before using it for the present study.

### Procedure Performed One Day Prior to the Treatment under GA (T0)

One day prior to the treatment (T0) under general anesthesia, the child's mother was interviewed in a local language by a trained and calibrated examiner and the study proforma was filled. Clinical examination and oral health parameters were recorded by seating the child on the lap to lap position using a mouth mirror, Williams probe, and tweezers taking due precautions for infection control.

### On the Day of Procedure

On the day of the procedure, the adherence to NPO instructions was assessed and systemic health status was evaluated by an Anesthetist. Treatment was deferred for the children with fever, upper respiratory tract infection, etc., for the next 2–4 weeks till the complete solution of these symptoms. Children found to be fit for GA were draped, intubated, and prepared with 5% betadine followed by complete oral rehabilitation done in a standard dental anesthesia setting. On completion, the extubation procedure was carried out and the child was shifted to the recovery room for careful monitoring by the dental and anesthetic team until deemed fit for discharge. The patient was recalled after 24 hours follow-up to evaluate the postoperative status and immediate recovery. None of these children reported any post-operative complications. Subsequent follow-up visits were scheduled at 1 month (T1) and

3 months (T2) and the oral hygiene instructions were reinforced before sending the child to home.

### At 1 Month (T1) and 3 Months (T2) Follow-up

At T1, mothers were interviewed in the local language and only the third section of the proforma was filled. Further at T2, i.e., 3 months follow-up the same procedures were repeated along with topical fluoride varnish application. At each follow-up visit, instructions for promoting good oral health viz. the importance of oral hygiene, the age-specific use of fluoridated dentifrice, limited use of sugar, and limitation of the frequency of snacking were reinforced.

### Analysis of Quality of Life

To represent OHRQoL, all the scores were added up to obtain the final ECOHIS score; a higher value suggested a greater impact on the quality of life.<sup>15</sup> No score was recorded for responses marked as "Don't know" as most of the children involved were in the pre-cooperative stage. The total scores were calculated for the entire ECOHIS under the following domains viz. child symptoms, child function, child psychology, child social well-being, parent distress, and family function.

The extent of change in OHRQoL after the complete oral rehabilitation was obtained by calculating the difference between the post-treatment ECOHIS scores and the baseline scores and similar calculations were carried out for individual domains as well. To obtain the effect size, the mean change score was divided by the standard deviation (SD) of the baseline score. An effect of <0.2 indicated a small, albeit clinically significant magnitude of change, 0.2–0.7 indicated a moderate change and >0.7 indicated a large change.<sup>16</sup>

### STATISTICAL ANALYSES

Analysis was conducted using IBM SPSS STATISTICS software (version 22.0). The Normality of the variables (quantitative data) was tested with the Shapiro-Wilk test/Kolmogorov Smirnov tests of normality. For time-related variables of skewed data, the Wilcoxon signed-rank test was applied (baseline to 1st month & after 3 months). Change for QOL scores was calculated by subtracting the value of each subject T0-T1, and then its mean was calculated. Categorical variables were reported as frequency and percentages. Group comparisons were made with the Chi-square

test or Fisher's exact test. All the statistical tests were two-sided and were performed at a significance level of  $\alpha = 0.05$ .

### RESULTS

A total of 50 children (26 males and 24 females) with a mean age of  $2.75 \pm 0.59$  were participated in the study with no statistically significant difference in gender distribution ( $p$  value = 0.284). There was no loss to follow-up at one and three months. The ICDAS score was converted into dmft as per Honkala et al.<sup>17</sup> and the resultant mean dmft score of the enrolled children was found to be  $11.10 \pm 4.70$ . The mean PI and GI scores of the enrolled children were found to be  $30.18 \pm 8.18$  and  $27.34 \pm 8.582$ , respectively. As per modified Kuppaswamy scale<sup>11</sup> of socioeconomic status updated for the year 2018, 62% of the sample belonged to the upper-middle class, 18% to lower-middle class, and 20% to the upper-lower class and their socioeconomic status did not have a statistically significant association with the OHRQoL ( $p$  value = 0.473), or with the oral hygiene status [plaque score ( $p$  value = 0.126) gingival score ( $p$  = 0.061) and dmft score ( $p$  value = 0.110)].

Frequent dental pain was reported in more than half of the children, and nearly 80% of them reported experiencing difficulties in eating. The majority of parents admitted to often feeling upset and guilty for the dental problems of their children and most of them had taken time off from work (Table 1). Following the complete oral rehabilitation, there was a significant decrease in the mean score of each of the domains at T1 and T2 when compared to baseline scores. Child self-image/social well-being was the solitary domain to have a moderate (0.35) effect size at T1, although it increased to a large effect size (>0.7) at T2. The largest decrease in scores was observed in the child symptoms and child function domains of the child section and in the parental distress and family function domains of the family impact section (Table 2). The total ECOHIS scores decreased post-operatively (T0 to T1), showing a significant ( $p$  value <0.001) improvement in the OHRQoL of the children after their dental treatment under GA, and continued to remain low at the three months recall (T0 to T2) (Flowchart).

### DISCUSSION

Early childhood caries is a common condition afflicting preschool children. Its rapidly progressive nature results in early pulpal involvement and other related clinical consequences, which

**Table 1:** Prevalence of reported impacts on the children and their family at baseline (N = 50)

Items	Prevalence of reported impacts (in %)			
	Never or Hardly ever	Occasionally	Often or very often	Don't know
Pain in the teeth mouth and jaws	12	36	46	6
Difficulty drinking hot or cold beverages	46	10	28	16
Difficulty eating some foods	20	8	70	2
Difficulty pronouncing some words	82	4	8	20
Missing preschool, daycare or school	40	10	16	34
Trouble sleeping	60	12	28	0
Being irritable or frustrated	38	18	30	14
Avoided smiling or laughing	44	2	2	52
Avoided talking	42	2	4	52
Parents being upset	40	28	28	4
Parents feeling guilty	46	18	30	6
Parents taking time off from work	30	26	44	0
Financial impact on the family	76	8	16	0

**Table 2:** Domains of ECOHIS of children aged less than 5 years at baseline and at 1 and 3 months follow-up

Domains of ECOHIS	$T_0$ (Baseline)	$T_1$ (1 month after treatment)	$T_2$ (3 months after treatment)	Time Interval	Mean change in values		
	Mean $\pm$ S.D.	Mean $\pm$ S.D.	Mean $\pm$ S.D.		Mean $\pm$ S.D.	Effect size	Significance (p value)
Child symptom domain	3.62 $\pm$ 1.33	1.30 $\pm$ 0.81	1.06 $\pm$ 0.31	$T_0$ - $T_1$	2.32 $\pm$ 1.37	1.69	0.001*
				$T_0$ - $T_2$	2.56 $\pm$ 1.35	1.86	0.001*
				$T_1$ - $T_2$	0.24 $\pm$ 0.89	0.17	0.063
Child function domain	13.62 $\pm$ 5.21	7.56 $\pm$ 3.39	6.46 $\pm$ 2.78	$T_0$ - $T_1$	6.06 $\pm$ 4.84	1.25	0.001*
				$T_0$ - $T_2$	7.16 $\pm$ 4.96	1.48	0.001*
				$T_1$ - $T_2$	1.10 $\pm$ 2.27	0.23	0.001*
Child psychological domain	5.64 $\pm$ 2.91	3.08 $\pm$ 1.60	2.64 $\pm$ 1.30	$T_0$ - $T_1$	2.56 $\pm$ 2.73	0.94	0.001*
				$T_0$ - $T_2$	3.00 $\pm$ 3.18	1.16	0.001*
				$T_1$ - $T_2$	0.44 $\pm$ 1.820	0.67	0.094
Child self image/social interaction domain	7.52 $\pm$ 4.34	5.94 $\pm$ 4.68	5.98 $\pm$ 4.55	$T_0$ - $T_1$	1.58 $\pm$ 4.55	0.35	0.018*
				$T_0$ - $T_2$	1.54 $\pm$ 4.04	1.00	0.010*
				$T_1$ - $T_2$	0.04 $\pm$ 3.65	0.00	0.939
Parental distress domain	5.74 $\pm$ 2.89	2.90 $\pm$ 2.15	2.7 $\pm$ 2.18	$T_0$ - $T_1$	2.84 $\pm$ 2.68	1.06	0.001*
				$T_0$ - $T_2$	1.54 $\pm$ 4.04	1.05	0.001*
				$T_1$ - $T_2$	0.20 $\pm$ 1.10	0.41	0.207
Family function domain	4.86 $\pm$ 2.17	2.46 $\pm$ 0.67	2.04 $\pm$ 0.19	$T_0$ - $T_1$	2.40 $\pm$ 1.88	1.27	0.001*
				$T_0$ - $T_2$	2.82 $\pm$ 2.14	1.14	0.001*
				$T_1$ - $T_2$	0.42 $\pm$ 0.67	0.36	0.001*
Total ECOHIS	41.00 $\pm$ 11.51	23.24 $\pm$ 6.96	20.84 $\pm$ 6.42	$T_0$ - $T_1$	30.80 $\pm$ 20.84	1.62	0.001*
				$T_0$ - $T_2$	34.86 $\pm$ 20.40	1.04	0.001*
				$T_1$ - $T_2$	4.06 $\pm$ 9.95	0.31	0.09

\*p value < 0.05 = statistically significant

detrimentally affect the quality of life of children.<sup>2</sup> The extensive form of ECC, where almost the entire deciduous dentition gets involved, further worsens the OHRQoL of afflicted children. Additionally, such extensive grades of ECC in young uncooperative children impose financial burden, stress, and guilt upon their parents.<sup>18</sup>

Although, oral health education is known to be an integral part of the primary prevention of ECC where it has already set in, complete rehabilitation of carious teeth is imperative to prevent them from the inevitable consequences of untreated dental diseases. Chair-side management of these children poses a challenge for pediatric dentists because of the limited cognitive ability at this age making it impossible to employ conventional behavior management techniques for their dental treatment. Thus, the management of these young, potentially uncooperative children necessitates the use of other available pharmacological techniques which include nitrous oxide/oxygen inhalation, deep sedation, or general anesthesia. The former two techniques have certain inherent drawbacks as dental procedures often require two or more sedation appointments in children with extensive dental caries along with the added risk of LA overdosing in young children.<sup>19</sup> Thus, GA may be more beneficial in managing such children with ECC because of the various advantages it offers over the other pharmacological methods viz. the treatment can be done in a single appointment, no behavior modification needed, better parent cooperation for treatment under GA, fast recovery after the treatment, and fewer side effects from drugs used during the procedure. General anesthesia has been used for providing comprehensive dental rehabilitation in young pre-cooperative

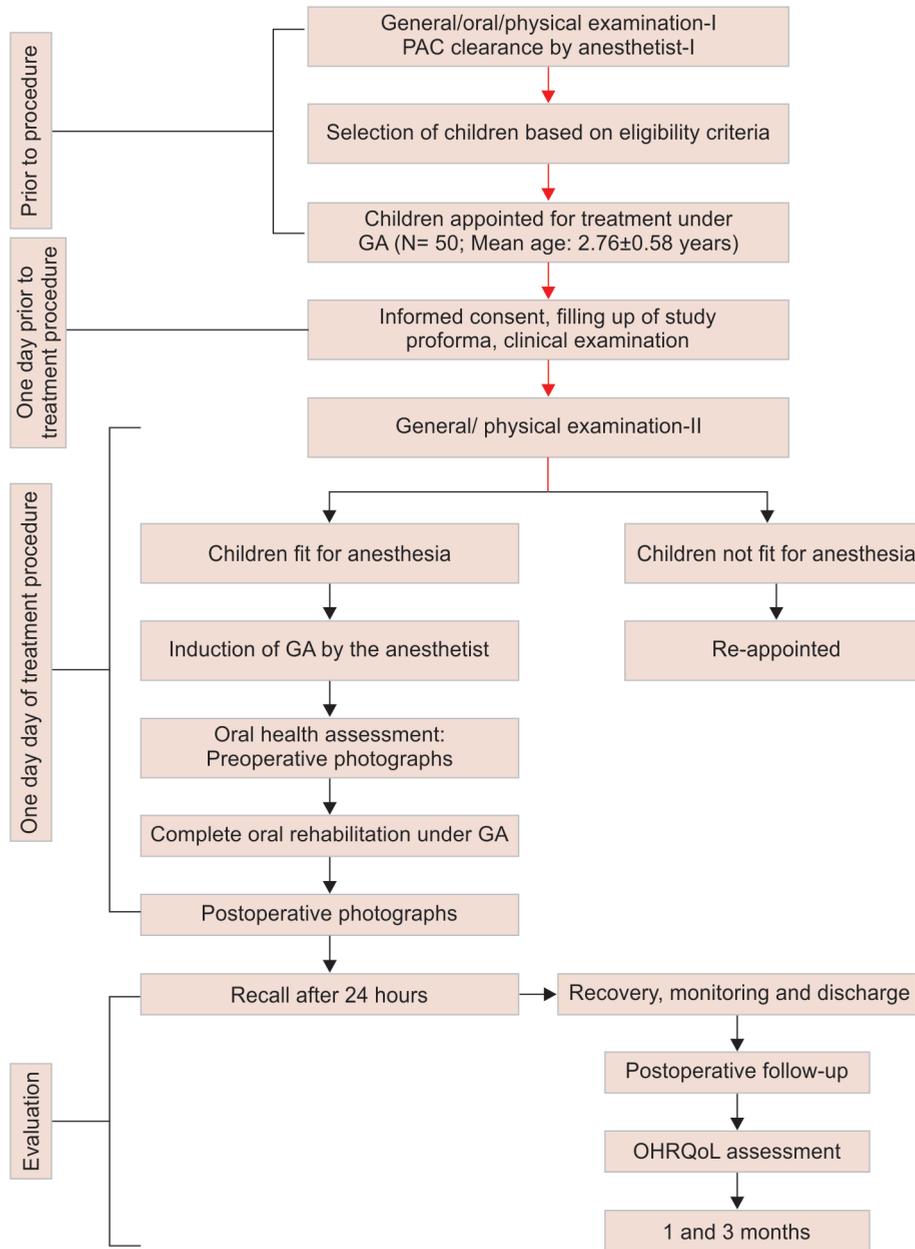
children with extensive dental care needs.<sup>20</sup> The significant change in the OHRQoL of the children following complete oral rehabilitation under GA also has been reported by several authors viz. Li et al.,<sup>5</sup> de Souza et al.,<sup>6</sup> Gaynor et al.<sup>7</sup> and Anderson et al.<sup>20</sup> among children in the age range of 5–8 years.

Oral Health-related quality of life is the impact that oral health has on an individual's basic functioning (eating, speaking, pain), psychological well-being (appearance and self-esteem), and social well-being. OHRQoL, as a concept, advocates that any intervention or treatment aimed at improving oral health should result in an improvement of the individual's overall QoL.<sup>18</sup> This can be measured through a questionnaire based on the child's oral health known as the child oral health quality of life questionnaire. There are various questionnaires available in the literature to assess the OHRQoL in children viz. child perceptions questionnaire (CPQ), parental-caregivers perceptions questionnaire (P-CPQ), FIS. These scales are validated for children more than 8 years and their use in children less than 5 years is questionable primarily because the child domain of these scales requires the children to answer the questions which need a certain level of comprehension that pre-school children developmentally lack. Their validation only for children more than 8 years was the major consideration against their use in the present investigation.

The ECOHIS was developed and validated for the assessment of OHRQoL in younger children. It is a combination of the child impact and family impact scales, which uses the parent's perception of the impact of oral health on their child for the child impact domain and thus, makes it possible for use in preschool children who cannot



Flowchart 1: Changes in total ECOHIS and domains at baseline, 1 month and 3 months follow-up



respond for themselves. This ECOHIS scale has been validated by Pahel et al.<sup>14</sup> on 296 parents of 3–5 years old children. Global data on the dental treatment of young children under general anesthesia and its positive impact on their quality of life exists.<sup>21,22</sup> However, such data for the Indian demographic is scarce.

The findings of the present study show a significant improvement in OHQRoL after complete oral rehabilitation under general anesthesia. This treatment effect was found to sustain throughout the follow-up at 1 and 3 months post-treatment and also showed a positive impact on the parents. At baseline, the most affected domains were the child function domain (13.62 ± 5.21) and the child symptom domain (3.62 ± 1.33). After complete oral rehabilitation under GA, these domains exhibited the greatest improvement when compared to baseline. Jankauskienė et al.<sup>1</sup> had shown the largest decrease in the mean scores of child symptoms and child psychology domains in Lithuanian children. In the Arabian

population, a similar trend in terms of change in mean scores of child symptom domains was shown by Farsi et al.<sup>23</sup> This scale has been used by several other authors globally who have shown a significant improvement in the quality of life of pre-school children after complete oral rehabilitation under GA.<sup>1,6,7,15</sup>

The literature regarding the various indicators of poverty and ECC, suggests an inverse relation of the general socioeconomic status of the population with the prevalence of ECC, in particular the proportion of children with untreated caries.<sup>24</sup> However, in the present study, most of the children were found to belong to the upper-middle class (62%) followed by the lower middle class (18%) with no significant association with any other oral hygiene parameters. At 1 month post-operative follow-up, all the domains showed a significant change in the mean score except for child self-image and social interaction domains, possibly because of mother’s limited knowledge (most mothers responded with

"don't know") of their child's self-image regarding avoidance of talking or smiling with other children in their schools or daycare centers. A similar impact on the child's self-image was also mentioned by various other authors who assessed the change in OHRQoL after complete oral rehabilitation under general anesthesia.<sup>15,20,25-27</sup> The present study found an overall large effect size for the change in ECOHIS scores from baseline to 1 month ( $E S = 1.62$ ) as well as at 3 months ( $E S = 1.04$ ) after the complete oral rehabilitation under GA which was comparable with results reported by other authors.<sup>6,28-30</sup> The improvement in the OHRQoL of preschool children was thus found to be significant in the immediate post-operative period and remained stable during the subsequent follow-up visits. Though the result of this the authors wish to highlight the tangible of single visit complete oral rehabilitation and general anesthesia in young children with extensive decay and hope that more centers in India may consider this treatment option.

### Limitations and Future Prospects

The results of the present study compare similarly with other studies that have used ECOHIS to highlight the satisfactory analytical properties of the scale.<sup>17,31</sup> However, certain limitations of the ECOHIS have also been brought forward which question its propriety for use in young children with extensive dental care needs when compared to the new abridged P-CPQ and FIS scales.<sup>32</sup> Complete oral rehabilitation under GA, though is effective in improving OHRQoL in children with ECC, the functional limitations for the child and some associated parental distress may continue even after the treatment. A longer period of follow-up is needed to better establish the sustainability or stability of this score. In the present study only mothers were interviewed, in future investigations fathers as well as other family members may be included to allow for comparison in the attitudes towards the oral health of their child and the perception of OHRQoL by different caregivers.

### CONCLUSION

This longitudinal study resulted in a significant improvement in the involved children's OHRQoL as perceived by the Indian children's parents at one and three months follow-up after treatment under GA. Child symptoms and child function domain significantly improved immediately after the treatment and the improvement was persistent at the 3 months follow-up. The parents involved expressed their appreciation towards the convenience of having all of their child's dental care needs to be tended to at once through this treatment modality and its subsequential impact on the family's quality of life.

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