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de Souza, M.C., Harrison, M. and Marshman, Z. (2016) Oral health-related quality of life following dental treatment under general anaesthesia for early childhood caries - a UK-based study. International Journal of Paediatric Dentistry. ISSN 0960-7439

https://doi.org/10.1111/ipd.12221

Oral Health Related Quality of Life following dental treatment under General Anaesthesia for Early Childhood Caries – A UK based study.

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ABSTRACT

Objective
To assess parental reports of changes in oral health-related quality of life (OHRQoL) of young children in the UK with early childhood caries (ECC) following dental treatment under general anaesthesia (DGA). To compare the impact of oral rehabilitation (OR) and extraction-only (Exo) treatment approaches on this.

Methods
Data was collected using the proxy reported components of the Child Oral Health-Related Quality of Life (COHRQoL®) questionnaire: the Parent-Caregivers Perceptions questionnaire (P-CPQ) and Family Impact Scale (FIS), from a convenience sample of parents of children receiving DGA at a UK Paediatric Dental Department. Mean scores and prevalence impacts were compared pre- and post- operatively with mean change score and effect sizes calculations.

Results:
Seventy-eight parents were recruited (51 children undergoing OR, 27 Exo) with 6 lost to follow up (92.3%). Following treatment, changes in mean P-CPQ and FIS scores were statistically significant ($P<0.0001$) with medium to large effect sizes (0.45-1.39). The differences in change scores between the two treatment approaches were not statistically different.

Conclusion:
DGA for young children with early childhood caries resulted in substantial improvements in parent's ratings of their child's OHRQoL and of the impact on their families. Further research is needed in this area.

INTRODUCTION

Early childhood caries (ECC) remains a significant global problem. The impact of this disease can be measured in terms of oral health-related quality of life (OHRQoL) which has been defined as "the impact of oral disorders on aspects of everyday life that are important to patients and persons, with those impacts being of sufficient magnitude, whether in terms of severity, frequency or duration, to affect an individual's perception of their life overall" [1]. Previous studies have demonstrated poor OHRQoL in young children with caries in their primary teeth[2,3].

In the UK, young children referred to secondary care services for the management of ECC frequently have their dental treatment delivered under general anaesthesia (GA). In England dental treatment is the most common reason for a GA with over 62,000 children admitted to hospital for dental extractions during 2013/4 at an estimated cost to the National Health Service in 2012/3 of £30 million. Dental treatment under general anaesthesia (DGA) is typically due to children's pre-cooperative status and high-volume treatment need. The aim is to render the child dentally fit in one treatment session in a way that the child can cope with. The treatment itself typically comprises restorations and extractions of teeth as the caries pattern, extent and environment for care dictates. The use of GA for the provision of such care however, is costly and not without risk. Thus there is a need to assess the degree to which the treatment of caries under GA reduces the impact of the disease on children's daily lives in order to evaluate these services particularly when such services are publicly funded as in the UK.

The Child Oral Health Related Quality of Life (COHRQoL©) questionnaires were the first measures of child OHRQoL to be described and validated [4]. Studies in other countries have shown improvement in OHRQoL following DGA using these and other measures completed by parents[5]. However, this has not been investigated in the UK where 0.5% of the child population undergo a DGA each year [6.] Malden *et al.* (2008) had previously highlighted that in order to justify the use of finite health service resources to what is without question a 'resource -intensive' intervention, further evaluation of patient reported outcomes is required[7].

There are two distinct and well recognised treatment approaches to the management of ECC under GA commonly employed in the UK. These are the *extraction-only* (Exo) approach (where all carious teeth are extracted) and the *oral-rehabilitation (*OR*)* approach (where both restorations and extractions are carried out). The difference (if any) between the impact of these different intervention strategies on OHRQoL outcome has also not been previously investigated[7].

In view of this, the aim of this study was to assess the impact of ECC and it's treatment under GA on young children and their families' daily lives as perceived by their parents, using the Parent-Caregiver's Perceptions Questionnaire (P-CPQ) and Family Impact Scale (FIS) OHRQoL. Comparisons between the treatment groups were also made.

METHOD

Ethical approval was obtained from the North of Scotland Research Ethics Committee in April 2013. A pre-test post-test study design was adopted with parents of children attending for DGA at Guy's Hospital, London between the period July 2013 and February 2014.

It was calculated that 40 participants were required to detect an effect size of 0.4 at 5% level of significance with 80% power to detect this difference, assuming a correlation of 0.5 between the pre- and post-test measurements. A 50% loss was assumed, therefore recruitment continued until 40 participants had been followed up.

Parents of children with caries affecting a minimum of four primary molars in a dentition into which the first permanent molars were yet to erupt were approached. Only parents with sufficient English language skills to complete the measures were invited to participate. Children who had experienced previous DGA and those with complex medical conditions were not approached**.**

Study procedures

Of the 115 prospective participants eligible to take part, 32 declined and 5 were not recruited due to time constraints peri-operatively. Thus 78 participants were recruited at baseline (67.8%).

Measures

The P-CPQ and FIS from the COHRQoL[8] were administered face to face on the day of the GA and over the telephone a minimum of one month after. The P-CPQ and FIS had been previously evaluated for use in the UK[9]. A Likert scale with five response options was used to assess the *impact frequency*: never (and don't know) = 0, 'once or twice' = 1, 'sometimes' = 2, 'often' = 3, 'every day or almost every day' = 4.

Scores were summed to give total scores for the P-CPQ and FIS. Subscale scores were also calculated for the four domains within the P-CPQ: oral symptom, functional limitation, emotional well-being and social well-being and the four domains within the FIS (parent family activity, parental emotions, family conflict and economic impact).

Global ratings were also included and asked parents and caregivers to rate the overall state of their child's oral health (global oral health rating) and the extent to which the oral health condition affected their child's overall well-being (global life overall rating). Finally, at the end of the post-operative questionnaire parents were asked to score how their child's overall quality of life had been affected since the operation (global transition rating). All global ratings used a five point- Likert scale.

Statistical analyses

The score change following treatment was calculated by subtracting the post-operative score from the pre-operative score for the P-CPQ and FIS and their subscales. Therefore a positive change score indicated an improvement in OHRQoL, a negative changes score indicated a deterioration. This was assessed using a paired t test following log transformation of the total P-CPQ and FIS scores and using Wilcoxon paired tests for the subscale scores.

The effect size was calculated for the total and subscale scores to assess the 'magnitude of change' in terms of its clinical meaningfulness. The effect size was calculated by dividing the mean change scores by the standard deviation of the pre-operative scores. Thus a resultant effect size of less than 0.2 indicated a small magnitude of change, 0.2-0.7 a moderate change and where greater than 0.7 a large change[7].

Finally, the Minimally Important Difference (MID) of the total and subscale scores was calculated using the mean change scores of those who had reported 'little improvement' on the global transition rating. The MID is the smallest difference in score which the parent viewed as being beneficial. MID reference values were taken from Malden *et al*. (2008) who used an anchor based approach in which the global transition rating acted as the anchor or 'reference' point[7].

RESULTS

Sociodemographic characteristics

Seventy-eight parents were recruited with 6 parents lost to follow up (7.7%). The mean age of children was 4.8 years. Nearly two thirds (65.4%) of parents lived in the most deprived areas based on the 2010 Index of Multiple Deprivation[10] (Table 1).

Table 1: Socio-demographic characteristics at baseline, of those followed up and those lost to follow up.

Characteristic	Pre-operative n=78 (%)	Post-operative n=72 (%)	Lost to follow up n=6 (%)
Gender			
Male	40 (51.3)	35 (48.6)	5 (83.3)
Female	38 (48.7)	37 (51.4)	1 (16.7)
Ethnicity			
White	28 (35.9)	17 (23.6)	2 (33.3.)
Mixed	4 (5.1)	4 (5.6)	0
Asian/ British Asian	12 (15.4)	12 (16.7)	0
Black/Black British	8 (10.3)	6 (8.3)	2 (33.3.)
Other Ethnic Group	4 (5.1)	4 (5.6)	0
Not stated	22 (28.2)	20 (27.8)	2 (33.3.)
Age			
Mean, SD	4.76, 1.1	4.83, 1.1	3.93, 0.3
Median, Range	4.76, 2.00-6.86	4.94, 2.00-6.86	3.94, 3.52-4.22
2 years	5 (6.5)	5 (6.9)	0
3 years	16 (20.8)	12 (16.8)	4 (66.6)
4 years	23 (29.9)	21 (29.4)	2 (33.3)
5 years	23 (29.9)	23 (32.2)	0
6 years	11 (14.3)	11 (15.4)	0
Deprivation Level			
Most deprived	17 (21.8)	15 (20.8)	2 (33.3%)
More deprived	34 (43.6)	33 (45.8)	1 (16.6%)
Average	14 (17.9)	12 (16.7)	2 (33.3%)
Less deprived	9 (11.5)	8 (11.1)	1 (16.6%)
Least deprived	4 (5.1)	4 (5.6)	0

Treatment Data

The children of 51 participants received oral rehabilitation (OR group). The remaining 27 had exodontia only (Exo group)**.** Overall, 29.5% of the sample underwent ten or more extractions of which two children had full clearances. The mean number of carious teeth in the OR group was 8.82 and 10.37 in the Exo group– this difference was not statistically significant (p=0.237). However, nearly double the number of teeth were extracted in the latter (mean 10.58 S.D 4.43) than the former group (mean 5.67 S.D 3.27) p<0.0001. In the oral rehabilitation group, the mean number of stainless steel crowns, maxillary composites, maxillary extractions and proximal stripping performed were 1.82 (SD 1.78), 0.54 (SD 1.20), 1.98 (SD 2.21) and 0.17 (SD 0.63) respectively.

Mean Change Scores and Effect Sizes

The mean overall and subscale scores of the P-CPQ and FIS both pre- and post-operatively and their corresponding effect sizes are presented in Table 2. Reductions in scores were seen with all changes being positive (i.e. an improvement had occurred). Overall the reductions for the P-CPQ and FIS components were statistically significant (paired t test following log transformation $p<0.0001$). The largest effect sizes were seen for the parental emotions (FIS) and oral symptoms (P-CPQ) domains. The smallest effect sizes were seen for the social well-being (P-CPQ) and family conflict (FIS) domains.

Between treatment approaches, no significant difference was seen between the groups with respect to mean change score (independent t test following log transformation $p=0.26$).

Table 2: Mean overall and sub-scale scores of the P-CPQ and FIS both pre- and post-operatively and effect size.

Domain	Mean Score			Effect Size (description of size)
	Pre-operative	Post - operative	Change Score	
P-CPQ overall	18.72 (12.85)	5.83 (5.59)	12.89	1.00 (large)
Oral Symptoms[a]	5.71	0.74	4.97	1.39 (large)
Functional Limitations[a]	6.72	3.03	3.69	0.62 (medium)
Emotional Well- being[a]	4.36	1.1	3.26	0.87 (large)
Social Well-being[b]	1.94	0.97	0.97	0.39 (medium)
FIS Overall	9.41 (6.01)	1.46 (1.90)	7.95	1.32 (large)
Parental Family Activity	3.64	0.11	3.53	0.93 (large)
Parental Emotions[a]	5.14	1.18	3.96	1.54 (large)
Family Conflict[c]	0.63	0.15	0.48	0.45 (medium)

Statistically significant at $P<0.0001$[a], $P<0.005$[b], $P<0.05$[c] (Wilcoxon paired test)

Figure 1 illustrates the improvement seen in parent's ratings of their child's global oral health following treatment, with over 90% of parents scoring their child's oral health as good, very good or excellent compared to just over 10% pre-operatively. Before treatment, only 56.4% of parents recognised their child's oral health was poor – falling to 0% after treatment. On comparing the two treatment approaches, no significant differences were found between the

groups at baseline based on the global oral health rating (Mann Whitney p= 0.607) but a statistically significant difference was found post-operatively (Mann Whitney p<0.05).

Figure 1: Parental responses to the question 'How would you rate the health of your child's teeth, lips, jaws and mouth?

Figure 2: Parental responses to the question 'How much is your child's over all wellbeing affected by the condition of his/ her teeth, lips, jaws and mouth?

Finally, when asked about the effect of treatment on their child's overall quality of life, nearly half (43.1%) of parents reported that since the operation their child's overall quality of life had improved with a quarter (26.4%) reporting no effect (Figure 3). However, the difference in responses between the two treatment groups for this question was not statistically significantly (Mann Whitney p=0.995). The three parents who reported deterioration in their child's quality of life, produced positive score changes (i.e. an improvement) when their responses to the P-CPQ and FIS were examined.

Figure 3. Parental response to the question 'Since the operation to treat your child's teeth, how has their overall quality of life been affected...?'

Minimally Important Difference (MID)

Table 4 show the data relating to the number of patients who demonstrated change scores that were at least the MID (mean change score of those for whom a little improvement was reported in the global transition rating). For 54.2% of participants the change scores were at least the MID for the PCPQ and FIS both overall and by subscale (except for the family conflict domain). MID reference values for the PCPQ and FIS and their sub-scales were taken from previous work [7,11].

Table 4: Number of patients who demonstrated change scores that were at least the MID overall for PCPQ and FIS and by subscale.

	MID*	**No. (& %) with change scores at least equivalent to MID**		
		Whole sample n=72	**OR only n=47**	**Exo only n=25**
P-CPQ overall	12	39 (54.2%)	24 (51.1%)	15 (60%)
Oral Symptoms	5	39 (54.2%)	25 (53.2%)	14 (56%)
Functional Limitations	2	47 (65.3%)	30 (63.8%)	17 (68%)
Emotional Well-being	3	41 (56.9%)	27 (57.4%)	16 (64%)

Social Well-being	1	37 (51.4%)	20 (42.6%)	17 (68%)
FIS overall	5	47 (65.3%)	27 (57.4%)	20 (80%)
Parental Family Activity	2	46 (63.9%)	27 (57.4%)	19 (76%)
Parental Emotions	3	51 (70.8%)	31 (66%)	20 (80%)
Family Conflict	1	22 (30.6%)	13 (27.7%)	9 (36%)

*Rounded up where mean change would be 0.

DISCUSSION

This is the first study in the UK to have investigated changes in the impact of ECC on the daily lives of young children and their families following dental treatment under GA. Furthermore, this is the first study to have attempted to make a comparison between two distinct but well recognised approaches to managing ECC in young children under GA.

Overall, a significant improvement in OHRQoL was reported by parents using the P-CPQ and FIS measures with over half reaching the MID, a difference that a person perceives as being important to them. These findings mirrored those seen in other developed countries [7, 12-14]. Changes were smallest in the social wellbeing subscale – also comparable with results in other studies for children of this age group [7, 12,13]. Between the two treatment groups no significant differences between the mean change scores were found. This is to be expected given short term improvements in OHRQoL typically reflect symptomatic relief of the child's dental status rather than the actual treatment delivered under GA *per se* [14]. Furthermore, the question of whether existing OHRQoL instruments themselves are sensitive enough to measure the impact of different treatment approaches in the management of ECC under GA must be raised.

This study demonstrated a high retention rate of participants and the demographic characteristics of patients involved were typical of those for whom the use of DGA is intended. Given that a high proportion of the sample lived in deprived areas, this study also confirms that such patients tend to carry the greatest burden of the disease[15]. Children in the Exo group had twice as many teeth extracted as those in the OR group despite similar numbers of carious teeth. This may indicate greater severity of disease in the former group, dictating the need for more aggressive treatment methods. However, further research is needed with larger sample sizes and longer follow-up periods to evaluate how the impact of treatment under DGA differs between treatment approaches and the sustainability of treatment effects. Given the high costs to the National Health Service of DGA in the UK the cost effectiveness of treatment approaches in relation to the changes in OHRQoL also requires further consideration.

Of interest, over 40% of parents failed to appreciate their child's oral health was poor prior to treatment. This may reflect poor parental awareness of the impact of dental caries on their children. However, following treatment, parents appeared to acknowledge their child's improved oral health more in the OR group than in the Exo group with a third more *very good* or *excellent* ratings. Could this suggest that parents perceive preservation of carious primary teeth to be better for oral health than an extraction-only approach? This may explain why anecdotally parents are often keen to save as many teeth as possible and in turn failing to appreciate other important influencing factors in the treatment decision, for example the extent of the lesion extent or overall caries risk. Furthermore, the variability of response to the question about oral health status and effect on child's wellbeing may indicate that parents did not fully understand the question being asked and/ or recognise the negative effect of poor oral health and the positive effect of good oral health to a child's wellbeing.

The limitations of this study must be noted. This was an uncontrolled, non-randomised study – features which would be difficult to overcome in this area of research for ethical reasons. Sampling bias was introduced through the use of a convenience sample and through exclusion of those with low levels of literacy. Finally, the use of proxy reporting is not a substitute for self- reporting and may bring with it a caregiver burden bias. However, it has been shown to be an important adjunct especially for young children[16, 17.] Further research is needed using a child-report measure developed and evaluated for use with young children undergoing dental treatment under GA.

CONCLUSION

The provision of dental treatment under GA for young children with ECC and their families resulted in substantial improvements to their OHRQoL as reported by their parents, irrespective of the treatment approach employed.

What this paper adds

Further evidence in support of:

- The use of GA to reduce the impact of dental caries on the daily lives of young children.
- The use of the P-CPQ and FIS scales as proxy reported measures of OHRQoL for young children.

Why this paper is important to paediatric dentists

ECC is shown to negatively impact on the daily lives of children and their families and management under GA can lead to improvements in OHRQoL. Further research is needed to examine, from the perspective of children themselves, changes in the impact of dental caries on their lives and to compare the impact of different treatment approaches to its management.

Acknowledgements

The authors would like to thank Andiappan Manoharan for his statistical support and to the participants who took part in this study.

Conflict of Interest
The authors declare no conflicts of interest in this study.

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