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# Parental-caregiver perception of child oral-health related quality of life following zirconia crown placement and non-restoration of carious primary anterior teeth

**ABSTRACT**

***Aim*** *Dental caries in preschool children has shown significant impact on children's OHRQoL and family functioning. The aim of this study was to measure parents' perceptions of children's OHRQoL and impact of children's orofacial conditions on the family following management of carious anterior teeth with either zirconia crown placement or non-restorative therapy.*

***Materials and methods*** *Parents of medically fit children aged from 2 years to 6 years attending specialist paediatric clinics were recruited and a questionnaire that included the Global Oral Health Rating Item, Parent-Caregivers Perception Questionnaire (P-CPQ-8) and Family Impact Scale (FIS-8) was distributed at a recall visit 3–6 months following treatment. Twenty patients were allocated in each of the two groups; zirconia crown and non-restorative therapy.*

***Results*** *The Global Oral Health Rating item scores were significantly different between groups (p=0.038). Children health effects due to dental status were more among patients treated with zirconia crowns. However, PCPQ and FIS total and individual scores were not significantly different between groups (p>0.05) except that children suffered more food impaction between teeth among patients treated with zirconia crowns (p=0.002).*

***Conclusions*** *Parents' perceptions of children's OHRQoL and impact on family were similar when anterior carious teeth were managed with zirconia crown placement or non-restorative therapy.*

***Keywords*** *Non-restorative therapy; OHRQoL; Primary teeth; Zirconia crowns.*

## Introduction

In the past decades, oral health-related quality of life (OHRQoL) has played an important role in theoretical, political and practical applications including clinic-based and public health measures [Gilchrist et al., 2014]. By showing the impact on daily life and general health of the individual and family, OHRQoL assessment has become more useful and relevant for health professionals in improving oral health and providing patient management.

Dental caries remains a public health problem worldwide [Edelstein, 2006] and has shown significant impact on children's well-being and family functioning [Abanto et al., 2011; Perazzo et al., 2017]. In preschool children, dental caries experience has shown a negative effect on OHRQoL of children and families [Scarpelli et al., 2013; Kramer et al., 2013]. The first teeth to be affected in early childhood caries are the upper anterior teeth which have an impact on aesthetics, function, social interactions and acceptance, and self-esteem [Dumas et al., 2001]. A recent study found that cavitated lesions on primary anterior teeth were associated with lower OHRQoL compared to white spot lesions, when associated with pain [Perazzo et al., 2017].

Options for management of carious anterior primary teeth include, conventional restorative treatment including tooth-coloured restoration, ART approach [Frencken et al., 2012], and non-restorative caries treatment [Gruythuysen, 2010]. Tooth-coloured restorations including zirconia crowns are becoming increasingly popular [Salami et al., 2015; Holsinger et al., 2016] due to the higher demand of aesthetic restorations and added influence of parents on the choice of restorative material. Paediatric zirconia crowns have shown to be an acceptable restorative option in primary teeth based on short term *in vitro* and *in vivo* studies [Walia et al., 2014; Ashima et al., 2014]. Parental satisfaction with zirconia crowns has been found to be high with 83% of parents perceiving that zirconia crown placement 'very much' improved their child's oral health [Holsinger et al., 2016].

The procedure of zirconia crown placement requires

increased chair-side time, significant amount of tooth structure removal and often pulp therapy of these teeth [Clark et al., 2016]. Because of the young age of the children usually affected with caries of primary teeth, cooperation is a problem and often a general anesthetic is required for their placement. As a result, the treatment of these teeth is often time-consuming, invasive and expensive.

Caries does not always progress and as a result a less surgical or operative approach has been suggested [Levine, 1980]. Minimal intervention dentistry aims to keep 'teeth healthy and functional for life' in accordance with the FDI policy of reducing the need for restorative therapy by emphasising caries prevention and moving towards a 'biological' approach [Frencken et al., 2012]. In a recent study, it was found that an ART-based approach achieved comparable levels of improvements in child OHRQoL when compared to standard care [Arrow and Klobas, 2015]. Recently researchers compared the incidence and types of failures between children managed using interim therapeutic restoration approach (ITR) and those managed under general anaesthesia, and found no difference between the incidence of pain and infection among the two groups [Lim et al., 2017].

From the point of view of the paediatric dentist, there is still no strong evidence of superiority of any particular restorative technique, material or option for restoring carious upper anterior primary teeth [Waggoner, 2015]. The aim of this study was to measure parents' perceptions of children's OHRQoL and impact of children's orofacial conditions on the family following management of carious anterior teeth with either zirconia crown placement or minimal intervention (non-restorative therapy). The hypothesis for this study was that parents' perceptions of children's OHRQoL and impacts of children orofacial condition on the family were different when anterior carious teeth were managed with zirconia crown placement and minimal intervention (non-restorative therapy).

## Materials and methods

Ethical approval was granted by the School of Dentistry Research Ethical Committee at the University of Jordan and the Deanship of Academic Research of the University of Jordan. The study was conducted in accordance with the World Medical Association's Declaration of Helsinki. Parents/caregivers of medically fit children aged from 2 to 6 years attending specialist pediatric clinics were recruited. The aim of the study was explained to the parents and consent forms were signed. A questionnaire in Arabic [Al-Riyami et al., 2016] was distributed to parents at a recall visit for their child in the clinic at 3–6 months following treatment. The questionnaire included demographic data, Global Oral Health Rating Item, Parent-Caregivers Perception Questionnaire (P-CPQ-8) and Family Impact Scale (FIS-8).

The Global Oral Health Rating Item was worded as follows "How much does the condition of your child's teeth, lips, jaws or mouth affect their life overall?". A 5-point Likert scale response rate ranging from "Not at all" = 0 to "Very much" = 5 was used.

The P-CPQ-8 measures the perceptions of parents/caregivers of the quality of life of their children, and is composed of 8 items distributed among four subscales: oral symptoms, functional limitations, emotional well-being and social wellbeing. Each item addresses the frequency of events as applied to the teeth, lips, jaws and mouth in the previous 3 months. The FIS-8 determines the impact of children's oral and orofacial conditions on the family [Locker et al., 2002]. It consists of 8 items divided into 3 subscales: parental/family activity, parental emotions and family conflict. A five point Likert scale was used with the following options: "Never"=0, "Once/twice"=1, "Sometimes"=2, "Often"=3 and "Every day/almost everyday"=4. A 'Don't know' response also was allowed and was scored as 0.

Twenty patients were allocated in each of the two groups according to the treatment provided. The first group was treated by placement of zirconia crowns (NuSmile, Houston, Texas) for anterior teeth restored due to dental caries in isolation or as a comprehensive plan for management of all teeth. These were compared to a minimal intervention group; patients whose anterior teeth were affected by caries involving the dentine with no signs of irreversible pulpitis or infection and the remainder of the dentition was disease-free or had been previously treated. In this case it was decided to avoid any invasive treatment and follow minimal intervention concept by utilising an oral health program including oral hygiene and diet control rather than restore the teeth. For both groups, routine preventive advice was given. All patients were treated by a specialist paediatric dentist. The choice of treatment in both groups was dependent on the paediatric dentist and on the parents' choice of treatment and considerations relating to cost, parental preference and degree of intervention desired.

### *Statistical analysis*

The SPSS computer software (Statistical Package for the Social Sciences, v19.0, SPSS Inc.) was used to perform data analysis for this study. Descriptive statistics were calculated then Pearson's correlation test was used to assess relationships between different variables within each study group. ANOVA test was used to compare differences between groups. Statistically significant levels were pointed out at $P \leq .05$ and 95% Confidence Interval. The sample size for this study was determined using the software G*Power 3.1.9.2 (Heinrich-Heine-University Dusseldorf, Dusseldorf, Germany) following a pilot study. The a priori design was utilised in the

software, in which the treatment was considered the independent factor and the P-PCQ-8 questionnaire scores as the variable factor. With a significant level of 5%, statistic power of 80%, and effect size of 20%, the minimum sample size was calculated as 18 participants for each group. A total of 20 participants were recruited into each group to compensate for possible dropouts.

## Results

Table 1 presents the distribution of demographic data among the study sample. Table 2 and 3 show the distribution of responses to the P-CPQ and FIS questions. The data obtained from 20 parents were analysed in each group. Pearson correlation test showed that among the patient group, the total score of PCPQ was not related to parent's gender, level of education, and general health (P>0.05). However, the total scores of PCPQ were significantly related to the dental health of parent (r=-0.475, p= 0.035). Higher total scores of PCPQ were associated with worse parent dental health. On the other hand, the total score of PCPQ among the control group was not related to parent's gender, level of education, and parent dental health (P>0.05). However, the total scores of PCPQ were significantly related to the general health of parent (r=-0.615, p=0.004). Higher total scores of PCPQ were associated with worse parent general health.

Among patients, the child health effects due to dental status (Global Health item) were significantly related to the total scores of PCPQ (r=0.550, p=0.012) and FIS (r= 0.489, p=0.029). Higher PCPQ or FIS total scores were associated with more effects on child health due to dental status. On the other hand, global health item scores were not related to PCPQ (r=0.218, p=0.357) or FIS (r=0.379, p=0.100) total scores among controls.

Pearson correlation test showed that in the patient group, the total FIS score was not related to parent's gender, level of education, and general dental health. However, the total FIS scores were significantly related

| | Zirconia* N=20 | Non-treatment* N=20 |
|---|---|---|
| Parent | | |
| Male | 12 | 10 |
| Female | 8 | 10 |
| Mean age (SD) | 39 (5.7) | 38 (5.2) |
| Education level | | |
| Secondary school | 3 | 1 |
| University | 17 | 19 |
| Self-reported general health | | |
| Excellent | 14 | 15 |
| Very good | 6 | 3 |
| Good | 0 | 2 |
| Fair/poor | 0 | 0 |
| Self-reported oral health | | |
| Excellent/ | 6 | 7 |
| Very good | 8 | 7 |
| Good | 4 | 4 |
| Fair | 2 | 1 |
| Poor | 0 | 1 |
| CHILD | | |
| Male | 10 | 8 |
| Female | 10 | 12 |
| Mean age (SD) | 4.3 (0.8) | 4.9 (1.2) |
| The Global Oral Health Rating Item | | |
| No effects | 8 | 12 |
| Very little effects | 5 | 7 |
| Sometimes affected | 6 | 1 |
| Many effects | 1 | 0 |

SD= Standard Deviation, *= ANOVA test showed no significant differences between groups in terms of children's gender, age and cause of dental visit as well as parents' gender, age, education, general health, and dental health.

TABLE 1 Distribution of demographic data among the study sample.

| | Zirconia n=20 (%) | | Non-treatment n=20 (%) | |
|---|---|---|---|---|
| How often (has your child) had… | Never/ Hardly ever | Occasionally/Often /Very often | Never/ Hardly ever | Occasionally/Often /Very often |
| Pain in the teeth, mouth or jaws | 14 (70%) | 6 (30%) | 15 (75%) | 5 (25%) |
| Food caught between teeth | 8 (40%) | 12 (60%) | 17 (85%) | 3 (15%) |
| Difficulty chewing firm foods | 15 (75%) | 5 (25%) | 19 (95%) | 1 (5%) |
| Slow eating | 14 (70%) | 6 (30%) | 15 (75%) | 5 (25%) |
| Felt irritable/frustrated | 16 (80%) | 4 (20%) | 18 (90%) | 2 (10%) |
| Felt upset | 16 (80%) | 3 (20%) | 18 (90%) | 2 (10%) |
| Not wanted to talk to other children | 19(95%) | 1 (5%) | 19 (95%) | 1 (5%) |
| Missed school | 19 (95%) | 1 (5%) | 19 (95%) | 1 (5%) |

TABLE 2 Distribution of Responses to P-CPQ in the two groups (Zirconia and non-treatment).

| How often have you or another family member... | Zirconia n=20 (%) | | Non-treatment n=20 (%) | |
|---|---|---|---|---|
| | Never/ Hardly ever | Occasionally/Often /Very often | Never/ Hardly ever | Occasionally/Often /Very often |
| Felt upset because of your childs' dental problems or dental treatments | 16 (80%) | 4 (20%) | 14 (70%) | 6 (30%) |
| Felt guilt because of your child's dental problems or dental treatments | 19 (95%) | 1 (5%) | 18 (90%) | 2 (10%) |
| Had sleep disturbances due to your child's dental problems | 17 (85%) | 3 (15%) | 19 (95%) | 1 (5%) |
| Took time off work because of child problems or dental treatments | 18 (90%) | 2 (10%) | 18 (90%) | 1 (5%) |
| Spent less time with myself or family because of child's dental problems or dental treatments | 18 (90%) | 2 (10%) | 18 (90%) | 2 (10%) |
| Been blamed by other people for your child' dental problems | 17 (85%) | 3 (15%) | 17 (85%) | 3 (15%) |
| Had argument with your child or another family member | 17 (85%) | 3 (15%) | 16 (80%) | 4 (20%) |
| Your child needed more care from you or another member of the family | 13 (65%) | 7 (35%) | 16 (80%) | 4 (20%) |

TABLE 3 Distribution of Responses to FIS-8 in the two groups (Zirconia and non-treatment).

| FIS items | | PCPQ Total Score | |
|---|---|---|---|
| | | Zirconia | Non-treatment |
| Parent feeling annoyed | r | .517* | .290 |
| | P | .020 | .215 |
| Parent feeling regretful | r | .665* | .301 |
| | P | .001 | .198 |
| Parent having sleep disturbance | r | .613* | -.216 |
| | P | .004 | .360 |
| Parent did not go to work | r | .348 | .296 |
| | P | .132 | .205 |
| Parent spent less time with self and family | r | .837* | .627* |
| | P | .000 | .003 |
| Parent being blamed | r | .406 | .233 |
| | P | .076 | .324 |
| Parent have arguments with the child | r | .712* | .269 |
| | P | .000 | .251 |
| The child needed more care from you | r | .284 | .541* |
| | P | .225 | .014 |
| FIS Total score | r | .704* | .599* |
| | P | .001 | .005 |

r=Pearson Correlation Coefficient, P= Probability value, *= significant relationship, PCPQ= Parental-Caregiver Perceptions Questionnaire, FIS= Family Impact Scale.

TABLE 4 Relationship between PCPQ total scores and FIS total and individual item scores among study sample.

| FIS items | | PCPQ Total Score | |
|---|---|---|---|
| | | Zirconia | Non-treatment |
| Child feeling pain in teeth, lips, jaw or mouth | r | .569* | -.149 |
| | P | .009 | .531 |
| Child suffering food impaction between teeth | r | .246 | .120 |
| | P | .295 | .615 |
| Child facing problems in biting and chewing hard food | r | .626* | .602* |
| | P | .003 | .005 |
| Child taking longer time during eating food | r | .469* | .006 |
| | P | .037 | .979 |
| Child feeling anxious or depressed | r | .442 | .688* |
| | P | .051 | .001 |
| Child feeling annoyed | r | .537* | .664* |
| | P | .015 | .001 |
| Child refused to talk to other children | r | .713* | .602* |
| | P | .000 | .005 |
| Child absent from school or nursery | r | .457* | .137 |
| | P | .043 | .565 |
| PCPQ Total score | r | .704* | .599* |
| | | .001 | .005 |

r=Pearson Correlation Coefficient, P= Probability value, *= significant relationship, PCPQ= Parental-Caregiver Perceptions Questionnaire, FIS= Family Impact Scale.

TABLE 5 Relationships between FIS total scores and PCPQ total and individual items scores among study sample.

to the dental health of parent (r=-0.624, p=0.003). Higher total FIS scores were associated with worse parent dental health. On the other hand, the total FIS scores among controls were not related to parents' gender and level of education. However, the total FIS score was significantly related to parent general health (r=-0.548, p=0.012) and parent dental health (r=-0.446, p=0.048).

### *Correlations between PCPQ and FIS total and single item scores among each group*

The total PCPQ scores were significantly related

| | | Sum of squares | df | Mean square | F | P |
|---|---|---|---|---|---|---|
| Child's health effects due to dental status | Between groups | 3.025 | 1 | 3.025 | 4.607 | .038 |
| | Within groups | 24.950 | 38 | .657 | | |
| | Total | 27.975 | 39 | | | |
| Child feeling pain in teeth, lips, jaw or mouth | Between groups | .025 | 1 | .025 | .026 | .873 |
| | Within groups | 36.950 | 38 | .972 | | |
| | Total | 36.975 | 39 | | | |
| Child suffering food impaction between teeth | Between groups | 9.025 | 1 | 9.025 | 10.734 | .002 |
| | Within groups | 31.950 | 38 | .841 | | |
| | Total | 40.975 | 39 | | | |
| Child facing problems in biting and chewing hard food | Between groups | 2.500 | 1 | 2.500 | 3.016 | .091 |
| | Within groups | 31.500 | 38 | .829 | | |
| | Total | 34.000 | 39 | | | |
| Child taking longer time during eating food | Between groups | 1.600 | 1 | 1.600 | 1.280 | .265 |
| | Within groups | 47.500 | 38 | 1.250 | | |
| | Total | 49.100 | 39 | | | |
| Child feeling anxious or depressed | Between groups | .400 | 1 | .400 | .454 | .505 |
| | Within groups | 33.500 | 38 | .882 | | |
| | Total | 33.900 | 39 | | | |
| Child feeling annoyed | Between groups | 2.025 | 1 | 2.025 | 2.094 | .156 |
| | Within groups | 36.750 | 38 | .967 | | |
| | Total | 38.775 | 39 | | | |
| Child refused to talk to other children | Between groups | .400 | 1 | .400 | .796 | .378 |
| | Within groups | 19.100 | 38 | .503 | | |
| | Total | 19.500 | 39 | | | |
| Child absent from school or nursery | Between groups | .000 | 1 | .000 | .000 | 1.000 |
| | Within groups | 12.400 | 38 | .326 | | |
| | Total | 12.400 | 39 | | | |
| PCPQ Total score | Between groups | 75.625 | 1 | 75.625 | 3.451 | .071 |
| | Within groups | 832.750 | 38 | 21.914 | | |
| | Total | 908.375 | 39 | | | |
| Parent feeling annoyed | Between groups | 1.600 | 1 | 1.600 | 1.382 | .247 |
| | Within groups | 44.000 | 38 | 1.158 | | |
| | Total | 45.600 | 39 | | | |
| Parent feeling regretful | Between groups | .225 | 1 | .225 | .622 | .435 |
| | Within groups | 13.750 | 38 | .362 | | |
| | Total | 13.975 | 39 | | | |
| Parent having sleep disturbance | Between groups | 1.225 | 1 | 1.225 | 3.709 | .062 |
| | Within groups | 12.550 | 38 | .330 | | |
| | Total | 13.775 | 39 | | | |
| Parent did not go to work | Between groups | .900 | 1 | .900 | 2.048 | .161 |
| | Within groups | 16.700 | 38 | .439 | | |
| | Total | 17.600 | 39 | | | |
| Parent spent less time with self and family | Between groups | .225 | 1 | .225 | .433 | .515 |
| | Within groups | 19.750 | 38 | .520 | | |
| | Total | 19.975 | 39 | | | |
| Parent being blamed | Between groups | .100 | 1 | .100 | .128 | .723 |
| | Within groups | 29.800 | 38 | .784 | | |
| | Total | 29.900 | 39 | | | |
| Parent have arguments with the child | Between groups | .100 | 1 | .100 | .106 | .747 |
| | Within groups | 35.900 | 38 | .945 | | |
| | Total | 36.000 | 39 | | | |
| The child needed more care from you | Between groups | .900 | 1 | .900 | .877 | .355 |
| | Within groups | 39.000 | 38 | 1.026 | | |
| | Total | 39.900 | 39 | | | |
| FIS Total score | Between groups | 1.225 | 1 | 1.225 | .065 | .801 |
| | Within groups | 719.750 | 38 | 18.941 | | |
| | Total | 720.975 | 39 | | | |

df= Degree of freedom, F= F statistics, P= Probability value, PCPQ= Parental-Caregiver Perceptions Questionnaire, FIS= Family Impact Scale.

TABLE 6 Comparison between groups in terms of Global Oral Health Rating item, PCPQ and FIS total and individual scores using ANOVA test.

to total FIS scores among zirconia group (r=0.704, p=0.001) and non-treatment group (r=0.599, p=0.005) (Tables 4 and 5). Poorer parents' perceptions of their children quality of life were associated with more impact of children's oral and orofacial conditions on the family among patients treated with zirconia and non-treatment groups. Table 2 presents the details of relationship between PCPQ total scores and FIS total and individual item scores. Table 3 demonstrates the details of relationships between FIS total scores and PCPQ total and individual items scores.

### *Comparison between groups regarding Global Oral Health Rating item, PCPQ, FIS total and individual item scores*

ANOVA test revealed that Global Oral Health Rating item scores were significantly different between groups (p=0.038) (Table 6). Children health effects due to dental status were more among patients treated with zirconia crowns. However, PCPQ and FIS total and individual scores were not significantly different between groups (p>0.05) except that children suffered more food impaction between teeth (item 2 of PCPQ scale) among those children treated with zirconia crowns (p=0.002) (Table 6).

## Discussion

This study showed that parents' perceptions of children's OHRQoL and impacts of children's orofacial condition on the family were similar when anterior carious teeth were managed with zirconia crown placement or non-restorative therapy. Therefore, the hypothesis presented in this study was rejected.

Measures of OHRQoL are important health outcomes to consider in clinical research to determine the effects of dental disease and its treatment on the child and family and are considered valid for oral health assessment [WHOQOL, 1995]. The scales used in this study were the Parental-Caregiver Perceptions Questionnaire (P-CPQ), and the Family Impact Scale (FIS), which have been evaluated for validity and reliability and have shown excellent psychometric properties [Jokovic et al., 2013]. Short versions of the P-CPQ and FIS have shown to be valid and responsive in longitudinal research [Thomson et al., 2013]. Using parents as proxy for young children is a good alternative to self-reporting when age and cognitive understanding is limited. Furthermore, self-reporting of dental pain by young children was found to be under-reported due to 'recall bias' where young children may not recollect all previous pain episodes [Leal et al., 2012].

All treatment done in this study was performed by specialist paediatric dentists to avoid any bias in the quality of care. The sample size of 20 children in each group is a convenient sample and is comparable to previous studies involving paediatric zirconia crowns [Salami et al., 2015; Holsinger et al., 2016]. The follow-up period of 3 to 6 months was believed to be adequate to report on OHRQoL in both groups.

Dental caries has a multifactorial aetiology with biological, environmental, social and cultural factors playing a role and influencing approaches and behaviours towards oral health [Edelstein, 2006; Holsinger et al., 2016]. Parental needs and concerns influence the perception of oral health problem as well as the type of oral care intervention [Divaris et al., 2014]. In both groups in this study, poorer parents' dental health was associated with higher FIS scores reflecting one way that parental factors may be related to oral health measures in children. Other parental factors that may influence the dental health and OHRQoL include parental stress [Menon et al., 2013], maternal depression [Seow et al., 2009], dental health-related locus of control [Dujister et al., 2015], and parenting practices [Dujister et al., 2015]. These and possibly more factors that may affect OHRQoL measures in children help explain the difference seen between the two groups in this study where the non-treatment group Global Health Item scores were not related to PCPQ or FIS total scores while the treatment group showed significant relation between PCPQ or FIS and the Global Health Item. Future work in this area is underway to explore parental attributes and their effect on dental health and ultimately child OHRQoL.

Many researchers have found that treatment of dental caries in children improves OHRQoL [Cantekin et al., 2014; Klaasen et al., 2009]. However, there is limited information on the effect of different management options for carious anterior teeth on OHRQoL. As a result, this study aimed to look at the effect of two extremes of management for carious anterior teeth; zirconia crown placement and a non-restorative option. As this study was retrospective it was difficult to control or match the severity of caries between the two groups. In addition, there may exist bias as a result of dependence on parents to ultimately decide on the treatment; either zirconia crowns or preferring to avoid the high cost and intervention by following preventive advice only. In the case of the non-restorative group, the parents may have been more motivated to follow preventive advice more vigilantly. Another important element is the high cost of zirconia crowns which may represent a difference in socioeconomic factors between the two groups.

The child self-image/social interaction domain was found to be not statistically different between the treatment and non-treatment groups in this study. This is in agreement with previous research showing negative association with OHRQoL in this domain [Abanto et al., 2011; Scarpelli et al., 2013]. In addition, another group of researchers found that prior to zirconia crown placement parents did not report their

children avoiding smiling [Holsinger et al., 2016]. One possible reason for this observation is that at this age children were too young to be self-conscious or be able to compare physical features with other children [Hetherington et al., 1999]. However, other work has shown that 4-5 year old children showed negative social perceptions and self-perceptions regarding altered aesthetics of traumatised primary anterior teeth [Soares et al., 2015].

In this study, the Global Oral Health Rating Item scores were significantly different between the study groups with the treatment (zirconia) group having more negative impacts. However, there were no significant differences in the PCPQ and FIS scores between the study groups except for more food impaction occurring with the zirconia group. These results are similar to previous findings of an investigation in Brazil that reported no difference in the OHRQoL between conventional restorative treatment, ART and ultraconservative treatment of carious primary molars of children after 1 year [Leal et al., 2013]. Similarly, other researchers found that of the caries-related consequences investigated (cavitated dentine lesions, toothache, history of extraction and the presence of fistulae), cavitated dentine lesions had least impact on the children's OHRQoL according to parents' perceptions [Leal et al., 2012]. Interestingly, the treatment component represented by tooth extraction showed greater impacts, possibly representing a traumatic experience for the child as well as a negative history of pain that fundamentally impacted the child and family's quality of life. Furthermore, researchers have found that children with dental caries and dental treatment report lower OHRQoL compared to children with no dental caries experience [Abanto et al., 2011; Wong et al., 2011]. Therefore, it is important to also consider the effect of dental treatment in general in terms of causing fear or aversion to dental care.

Previous research has shown no difference in the proportions of teeth extracted due to pain or infection whether a carious tooth was restored or left unrestored, either by cavity type or by tooth type [Tickle et al., 2002]. A 3.5 year prospective cohort study in China found that 81.5% of cavitated primary teeth left without restorations exfoliated without symptoms [Hu et al., 2013]. A retrospective study of outcomes of non-restoration of carious primary teeth found that 84% of 1,587 of teeth exfoliated without causing symptoms [Levine et al., 2002]. The highest numbers of teeth that exfoliated without symptoms or need for treatment were carious upper anterior teeth [Levine et al., 2002]. This latter study included carious teeth involving dentine that were symptomless but were left unrestored, similar to the non-restorative group in this study. Furthermore, a recent study showed that more children aged 6 years of age were willing to accept no treatment than their parents when shown photographs of mild anterior tooth caries [Pani et al., 2016].

There are many factors to consider when deciding on treatment of carious anterior teeth in young children. Primary incisors are not subject to dental caries unless the child is high caries-risk which may affect the performance of the restorations placed [Almeida et al., 2000]. Furthermore, caries development on these teeth tends to occur in very young children who may present with behaviour management difficulties and may need general anaesthesia or sedation to successfully complete the treatment [Waggoner et al., 2015]. The clinical success of the restoration as well as the effect on the OHRQoL are important considerations to take before choosing to perform restorations in young children. Consequently, non-restorative therapy in conjunction with appropriate preventive therapy and education may be an appropriate management option in certain cases. However, zirconia crowns remain a valid option in cases for grossly decayed teeth or teeth affected by developmental anomalies.

The study limitations are that the size of the study sample is small; however, the sample size in this study is comparable to or even larger than the sample size in previous investigations involving paediatric zirconia crowns [Salami et al., 2015; Holsinger et al., 2016]. Further studies are still required on larger study samples and to compare the measured variables following using paediatric zirconia crowns versus other treatments. Another limitation of the study is the subjective reporting of participants' responses to questionnaire items, an inherent pitfall in using any self-reported questionnaire. However, every attempt was made to provide the participants with full explanation of the measures used, and the investigator was readily available to answer questions and clarify any point for participants.

## Conclusion

Within the limitations of this study, it was concluded that parents' perceptions of children's OHRQoL and impacts of children's oral condition on family were similar when anterior carious teeth were managed with zirconia crown placement or non-restoration. Zirconia group patients reported more negative health impacts due to dental status.

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### *Conflict of Interest*

The authors declare no conflicts of interest.

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