

# Assessing changes in oral health-related quality of life and body growth in 3–5 years old children following dental treatment under general anaesthesia due to severe dental caries



G.F. Ferrazzano,  
G. Sangianantoni,  
R.L. Mitrano, A. Ingenito,  
B. Alcidi, T. Cantile

*Department of Neuroscience, Reproductive and Oral Sciences, School of Paediatric Dentistry, University of Naples, Federico II, Naples, Italy*

*e-mail: gianmariafabrizio@yahoo.it*

DOI 10.23804/ejpd.2019.20.03.09

## Abstract

**Aim** To evaluate the impact of oral treatment under general anaesthesia (GA) on oral health-related quality of life (OHRQoL) in children with severe dental caries; to assess the effect of dental treatment under general anaesthesia on children's weight (Wt), height (Ht) and Body Mass Index (BMI).

**Methods** One hundred uncooperative 3–5 years old children were selected. OHRQoL, assessed with the Early Childhood Oral Health Impact Scale (ECHOIS), Ht, Wt and BMI were measured at baseline and after 1 year from dental treatment under general anaesthesia. Statistics: All statistical procedures were performed using the Statistical Package for the Social Sciences (SPSS for Windows). ANOVA analysis was made to assess the effect of GA procedures on oral health quality of life in uncooperative children.

**Results** After 1 year, the reductions for the ECHOIS components were statistically significant ( $P < 0.0001$ ). Children showed a significant improvement in relation to pain, eating, sleeping and behavioural problems. At follow-up, there was a significant improvement in the anthropometric measures: 55% of children increased the percentile curves for weight and BMI; 44% for height.

**Conclusions** One year after a complete treatment under GA, both the OHRQoL and the growth improved.

## Introduction

Dental caries remains one of the most common diseases of childhood [Anderson et al., 2004; Ferrazzano et al., 2016; Ferrazzano et al., 2006], despite a global improvement in the last decade thanks to the use of preventive systems (fluoride prophylaxis, fluoride toothpaste, antibacterial mouthwash, control of oral hygiene) [Ferrazzano et al., 2015; Libonati et al., 2019; Marchetti et al., 2011]. The consumption of carbonated soft-drinks and unhealthy dietary habits have been associated with dental caries and tooth erosion in children [Ferrazzano et al., 2012]. In childhood dental caries is frequently untreated and represents a public health problem [Jankauskiene et al., 2014]. Children with untreated dental caries suffer from acute and chronic infections, pain, psychological discomfort, disturbed sleep, behavioural changes, and inability to eat, which leads to poor appetite and weight loss [Pakdaman et al., 2014; Wong et al., 2016]. Disturbed sleep affects glucocorticoid production [Sheiham, 2005]. In addition, chronic dental infections can affect erythropoiesis, leading to anaemia [Wong et al., 2016].

Managing very young children with dental caries in the conventional care setting is extremely difficult [Jankauskiene et al., 2014]. Although behavioural techniques and pharmacological approach (e.g., benzodiazepine) could be useful to obtain children collaboration, some paediatric patients are not able to tolerate dental treatments and may require alternative procedures, such as dental general anaesthesia (DGA) [Galeotti et al., 2016; Garret-Bernardin et al., 2017; Ferrazzano et al., 2008]. General anaesthesia is the most common modality for managing uncooperative children [Cuadros Fernández et al., 2014; Jankauskiene et al., 2014]. The reasons for choosing DGA include the extent of dental treatment needed (e.g. multiple extractions), behavioural management problems (e.g. a very young age), or systemic diseases [Klaassen et al., 2009]. DGA allows to provide a relatively safe and efficient high-quality treatment in a single operative session, with minimal discomfort to the patient [Anderson et al., 2004].

Using suitable questionnaires, it is possible to assess the effect of both dental disease and its treatment on patient's quality of life [Baghdadi, 2014]. Oral health related quality of life (OHRQoL) refers to the impact of oral health and/or oral disease on physical, psychological wellness, everyday life

**KEYWORDS** Dental caries, Children, Quality of Life, Early Childhood Oral Health Impact Scale, Body mass index, Weight, Height, Early childhood caries.

and social relationship [Jabarifar et al., 2009]. To this aim, in the last years, specific questionnaires on oral health-related quality of life (OHRQoL) have been elaborated in different languages [Baghdadi, 2014]. The Early Childhood Oral Health Impact Scale (ECOHIS) is the one designed for children in the 3–5 years age group [Wong et al., 2016; Lee et al., 2011].

Few studies exploring the impact on OHRQoL following dental treatment under GA in children have been conducted [Jankauskiene et al., 2014; Klaassen et al., 2009]. These studies revealed that dental treatment under GA leads to change in quality of life of children in all the aspects considered; significant improvement in oral health and psychological, social and overall wellbeing as well as a positive impact on the family [Baghdadi, 2014].

Growth is a significant indicator of child health; it is so crucial that the World Health Organization (WHO) recognises it as the best single measure for assessing nutritional and health condition of children [Edalat et al., 2014]. Anthropometry is the single most universally applicable, inexpensive, and non-invasive method available to assess the size, proportions, and composition of the human body. Paediatricians have for long used child growth as an important parameter in evaluating the health and general wellbeing of children [Gaur and Nayak, 2011]. Dental caries in children is reported to affect their anthropometric outcomes, but the evidence is conflicting [Jankauskiene et al., 2014].

Acs et al. [1999] showed the effect of dental rehabilitation under GA on the body weight of 51 children with early childhood caries. Prior to dental rehabilitation, patients weighed significantly less than caries-free healthy children from the same low socio-economic status population, with 13.7% of the children weighing less than 80% of their ideal weight. Comprehensive dental rehabilitation resulted in catch-up growth, such that children with a history of early childhood caries no longer differed in percentile weights from comparison patients at the follow-up 1.5-year after treatment. Contrary to previous report, Thomas and Primosch [2002] in a study on 50 healthy children treated under DGA for dental caries, showed that dental rehabilitation resulted in only a slight, non-significant improvement in the mean percentile.

Based on these considerations, the aims of this study were: To evaluate the impact of oral treatment under general anaesthesia (GA) on oral health-related quality of life (OHRQoL) in children with severe dental caries; to assess the effect of dental treatment under general anaesthesia on children's weight (Wt), height (Ht) and Body Mass Index (BMI).

## Material and methods

The study was carried out at the "Federico II" University of Naples (Paediatric Dentistry Department), Naples (Italy) in collaboration with the Department of Pediatrics.

All procedures performed were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Approval for this study was granted by the ethics committee of the "Federico II" University, Naples, Italy.

The study included 100 children (57 males and 43 females), aged between 3 and 5 years (average age  $3.94 \pm 0.89$ ), who received comprehensive dental treatment under general anaesthesia (GA), which included restorative/endodontic procedures, tooth extractions, and professional oral hygiene.

All the patients were consecutively recruited from the Paediatric Dentistry Department after a dental visit carried out by appropriately trained and experienced dentists under adequate lighting condition, using a plane buccal mirror, a dental explorer and air drying when necessary. All the patients

referred to DGA were uncooperative children (ASA I and II) with severe dental caries unable to accept dental procedures because of early age. Children affected by severe medical conditions and developmental disorders were excluded. All caregivers (parents/guardians) received information regarding the aims of the study and signed a written informed consent to participate in this study.

Anthropometric exams of each child were performed by trained personnel and a structured questionnaire on OHRQoL, using the Early Childhood Oral Health Impact Scale (ECOHIS) [Wong et al., 2016], was filled by the child's primary caregiver before (at baseline) and 1 year after DGA.

At baseline, anthropometric measurements were recorded, including height (Ht), weight (Wt) and Body Mass Index (BMI). All the measurements were made by a paediatrician using the standardised methodology recommended by the WHO [1995]. The Ht was measured using a stadiometer; Wt by electronic weighing machine with standard minimum clothing and without shoes.

The BMI was calculated with the formula:  $BMI = \text{weight (kg)} / \text{height}^2 \text{ (meters)}$ . Values thus obtained were plotted on age and gender specific growth charts recommended by the WHO.

Structured questionnaires were developed for pre- and post-treatment based on questions from "The Early Childhood Oral Health Impact Scale" (ECOHIS).

At baseline, parents/guardians answered 13 items grouped in two main parts: the child impact section and the family impact section. The child impact section covers four domains: child symptoms (1 item), child functions (4 items), child psychology (2 items), and child self-image and social interaction (2 items). The family impact section covers two domains: parental distress (2 items) and family function (2 items).

Parents/guardians were asked to consider the last 6 months when responding to questions. Response categories for the ECOHIS were coded: 0 = never; 1 = hardly ever; 2 = occasionally; 3 = often; 4 = very often; 5 = don't know.

ECOHIS scores were calculated as a simple sum of the response codes for the child and family sections separately, after recoding all "Don't know" responses to missing. For those with up to two missing responses on the child section or one missing on the family section, a score for the missing items was imputed as an average of the remaining items for that section. Parents with missing responses to more than two child items and one family item were excluded from the analysis.

One year after completion of clinical treatment, parents/guardians repeated a follow-up ECOHIS (post-treatment) and children were resubmitted to anthropometric measurements.

All statistical procedures were performed using the Statistical Package for the Social Sciences (SPSS for Windows). ANOVA analysis was made to assess the effect of DGA procedures on oral health quality of life in uncooperative children.

## Results

During the dental screenings, 100 children and their parents/guardians met the inclusion criteria of the study. All 100 parents interviewed completed all the items of the ECOHIS both pre- and post-treatment, and no questionnaires were excluded from data analysis due to missing data. At baseline questionnaires were filled out by the mother in 70% of the cases, by the father in 28% of the cases, and by others (e.g. guardians) in 2% of the cases. At follow-up questionnaires were completed by the mother in 67% of the cases, by the father in 30% of the cases, and by others (e.g. caregiver) in 3% of the cases.

	Never N(%)		Hardly ever N(%)		Occasionally N(%)		Often N(%)		Very often N(%)	
	T <sub>0</sub>	T <sub>1</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>0</sub>	T <sub>1</sub>	T <sub>0</sub>	T <sub>1</sub>
<b>Child impact section</b>										
How often has your child had pain in the teeth, mouth or jaws?	3	79	2	15	6	6	27	0	62	0
How often has your child, because of dental problems or dental treatments										
- had difficulty drinking hot or cold beverages?	13	89	10	7	16	3	31	0	30	1
- had difficulty eating some food?	10	84	6	12	13	2	26	2	45	0
- had difficulty pronouncing any words?	31	85	5	8	17	4	16	2	31	1
- missed preschool, daycare or school?	16	94	5	3	26	3	33	0	20	0
- had trouble sleeping?	27	86	4	12	17	1	26	1	26	0
- been irritable or frustrated?	9	86	5	11	12	2	33	1	41	0
- avoided smiling or laughing when around other children?	34	89	9	5	17	4	20	1	20	1
- avoided talking with other children?	39	95	4	2	16	2	18	1	23	0
<b>Family impact section</b>										
How often have you or another family member, because of your child's dental problems or dental treatments										
- been upset?	0	65	0	13	1	11	18	5	81	6
- felt guilty?	19	74	3	9	10	7	24	5	44	5
- taken time off from work?	28	88	3	1	18	9	34	2	17	0
How often has your child had dental problems or dental treatments that had a financial impact on your family?	31	83	4	11	16	5	38	1	11	0

TABLE 1 ECOHIS Questionnaire results.

	Baseline		Follow-up		P-value
	Mean (DS)	Range	Mean (DS)	Range	
<b>Child section</b>					
Child symptoms domain	4.43 (0.92)	1-5	1.27 (0.57)	1-3	0.0001
Child function domain	13.92 (3.48)	4-20	4.74 (1.52)	4-14	0.0001
Child psychological domain	7.12 (2.48)	2-10	2.35 (0.77)	2-6	0.0001
Child self-image/social interaction domain	5.65 (2.87)	2-10	2.29 (0.97)	2-7	0.0001
<b>Family section</b>					
Parent distress domain	8.51 (1.69)	4-10	3.32 (2.20)	2-10	0.0001
Family function domain	6.03 (2.35)	2-10	2.66 (1.43)	2-8	0.0001

TABLE 2 Total ECOHIS mean scores for each area at baseline and at follow up.

The results of the ECHOIS—both pre- and post-operatively—are presented in Table 1. Reductions in scores were seen with all changes being positive (e.g., an improvement had occurred).

The mean scores for the domains—both pre- and post-operatively—and their corresponding P-values are presented in Table 2. The reductions for the ECHOIS components were statistically significant (P < 0.0001).

Improvements in children's oral health after treatment are reflected in the differences between the total ECOHIS mean pre- and post-treatment scores.

All of the children showed a significant improvement regarding complaints of pain, eating, sleeping trouble or behaviour concerns.

At baseline, because of dental problems or dental treatment, more than 60% of children had difficulty drinking hot or cold beverages and had difficulty eating some foods "often" and "very often"; 69% had difficulty pronouncing any words at least once. More than 50% missed preschool,

daycare or school at least once. Only 27% had never trouble sleeping. Moreover, 74% had been irritable or frustrated, 40% had avoided smiling or laughing when around other children and 41% had avoided talking with other children. About the family impact section, 72% of parents required time off work to care for their child at least once, and 69% of children had dental problems or dental treatments causing a financial impact on their family; 100% of parents and/or another family member had been upset and only 19% has never felt guilty.

After 1 year, only 1% of children had difficulty drinking hot or cold beverages and 2% had difficulty eating some foods "often" and "very often"; only 15% had difficulty pronouncing any words at least once; 0% missed preschool, daycare or school days; 86% had never trouble sleeping. Approximately 90% had never been irritable or frustrated, had never avoided smiling or laughing when around other children and had never avoided talking with other children. About the family impact section, 12% of parents required

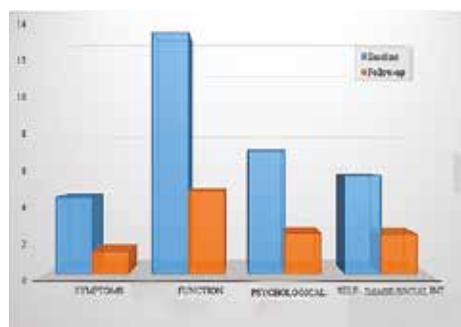


FIG. 1 Child impact section. Averages of total scores for each domain at baseline and at follow-up.

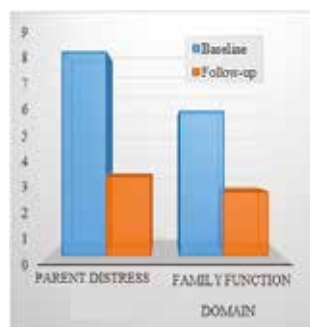


FIG. 2 Family impact section. Averages of total scores for each domain at baseline and at follow-up.

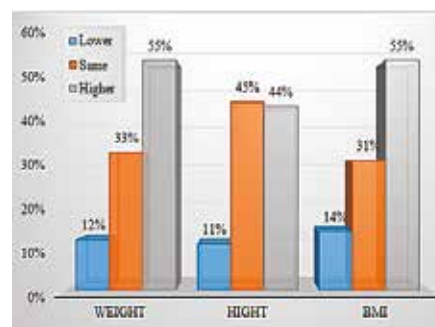


FIG. 3 Change in the percentile curves between the baseline and follow-up.

time off work to care for their child at least once; 17% of children had dental problems or dental treatments causing a financial impact on their family. Finally, 65% of parents had never been upset and 74% never felt guilty.

Graphic elaborations of the questionnaire results are represented in Figures 1 and 2. For each domain, the values are shown at baseline and at follow-up (Fig. 1, 2).

Anthropometric values (weight, height and BMI) are reported in Figure 3. At follow-up, about weight, 12% of patients were in a lower percentile than at baseline; for 33% of them the curve did not change; while in 55% of patients there was a shift toward a greater percentile between baseline and follow-up.

The results related to the height were as follows: 11% of patients were in a lower percentile at follow-up; 45% were in the same and 44% were in a higher percentile than at baseline.

Regarding the BMI, in 14% of cases the curve percentile at follow-up was lower than at the baseline; in 31% remained the same and in 55% of cases was higher than at the baseline.

## Discussion

Oral conditions are known to affect various aspects of quality of life (QoL) [Acharya and Tandon, 2011]. Although in 1976 Davis argued that oral disease has only minimal relevance for a person's life, during the following years this notion has been changed [Davis, 1976]. In fact, latest studies have demonstrated the association between the QoL and oral health [Anderson et al., 2004; Jankauskienė et al., 2017; Abanto et al., 2016; de Souza et al., 2017].

In the literature there is only one relatively old study analysing changes in incremental weight and well-being of children with dental caries following complete dental rehabilitation under general anaesthesia [Thomas and Primosch, 2002]. All other studies have analysed these two parameters separately [Anderson et al., 2004; Jankauskienė et al., 2014; Pakdaman et al., 2014; Wong et al., 2016; Baghdadi, 2014; Jabarifar et al., 2009; Jankauskienė et al., 2017; Abanto et al., 2016; de Souza et al., 2017; Costa et al., 2013; Acs, 1992].

In the present study, 100 preschool children, who received oral rehabilitation in a single session, were evaluated. A comprehensive rehabilitation under GA is often the only viable option to ensure quality dental care in uncooperative children with severe dental caries [Collado et al., 2017]. The results suggested that untreated severe dental caries had a negative impact on QoL, weight and height of the children. At the 1-year follow-up, there was an improvement in quality of life and in growth, undoubtedly.

Table 2 shows that the OHRQoL improved in each domain

after DGA treatment significantly.

The greatest improvement in this study was reported in child function domain; this result was similar to that of previous DGA studies [Anderson et al., 2004; Lee et al., 2011; Jankauskienė et al., 2017].

Although a systematic review reported that social wellbeing was the least affected domain [Jankauskienė and Narbutaitė, 2010], in this study a lower improvement was reported in symptoms domain.

The function domain included a question about the absence from school. In the USA, it was estimated that 100,000 children had lost 11,700 hours of school due to dental visits or dental problems [Sheiham et al., 2005]. Pain, discomfort and infections were the main cause of loss of school days with the consequently diminished ability to learn [Anderson et al., 2004]. In this study 84% of patients have missed school at least once, while after treatment this percentage dropped to 6%.

Clearly, the condition of a child with such a difficulty involved the whole family: parents needed to take time off from work, incurred numerous dental expenses and presumably had to prepare different food for their child. In fact, the results of this study indicated that a DGA rehabilitation is a benefit for the whole family.

About the relationship between caries and poor growth in young children, a possible cause could be associated to pain and inflammation due to untreated caries that affect the ability to eat [Acs et al. 1999; Acs et al., 1992; Sheiham et al., 2006]. Furthermore, chronic dental infection may affect erythropoiesis which may result in anaemia [Hahn and Falkler, 1992; Plitnick et al., 1998] and may influence sleep patterns [Exton, 1997; Kelley et al., 2003]. In turn, disturbed sleep influences growth hormone secretion [Gaur and Nayak, 2011; Phillip et al., 1999]. All these discomforts resulted in undernutrition and growth impairment [Acs et al. 1999; Acs et al., 1992; Sheiham et al., 2006].

In 1992, Acs et al. [1992] concluded that children with severe childhood caries had a lower weight than the control group. This result was similar to that reported in earlier studies [Gaur and Nayak, 2011; Thomas and Primosch, 2002; Miller et al., 1982]. Likewise, they reported that children had weight gain after receiving treatment [Acs et al., 1999].

In this study, after treatment, 55% of patients increased their weight and BMI, placing themselves in a greater percentile curve, while 44% increased their height. At baseline 18% of the sample had a weight below the 5th percentile, an obvious sign of insufficient growth, while the percentage dropped to 7% at follow-up.

Finally, as for the limitations of this study, it was not possible to include an untreated control group for ethical reasons.

## Conclusion

In paediatric dentistry, management of very young children with dental caries in the conventional care setting is extremely difficult. Children with untreated dental caries suffer from acute and chronic infections, pain, psychological discomfort, disturbed sleep, behavioural changes, and inability to eat, which leads to poor appetite and weight loss. This study revealed that dental treatment under GA leads to change in quality of life and body growth of children in all the aspects considered, and significant improvement in oral health and psychological, social and overall wellbeing as well as a positive impact on the family. Also, the ECHOIS questionnaire was valid and responsive to treatment-associated changes in young children with severe dental caries.

## References

- » Abanto J, Paiva SM, Sheiham A, Tsakos G, Mendes FM, Cordeschi T, Vidigal EA, Bönecker M. Changes in preschool children's OHRQoL after treatment of dental caries: responsiveness of the B-ECHOIS. *Int J Paediatr Dent* 2016;26:259-65.
- » Acharya S, Tandon S. The effect of early childhood caries on the quality of life of children and their parents. *Contemp Clin Dent* 2011;2:98-101.
- » Acs G, Lodolini G, Kaminsky S, Cisneros GJ. Effect of nursing caries on body weight in a pediatric population. *Pediatr Dent* 1992;14:302-5.
- » Acs G, Shulman R, Ng MW, Chussid S. The effect of dental rehabilitation on the body weight of children with early childhood caries. *Pediatr Dent* 1999;21:109-13.
- » Anderson HK, Drummond BK, Thomson WM. Changes in Children's Oral Health Related Quality of Life Following Dental Treatment under General Anesthesia. *Int J Paediatr Dent* 2004;14:317-325.
- » Baghdadi ZD. Effects of dental rehabilitation under general anesthesia on children's oral health-related quality of life using proxy short versions of OHRQoL instruments. *Scientific World Journal* 2014; doi: 10.1155/2014/308439.
- » Collado V, Pichot H, Delfosse C, Eschevins C, Nicolas E, Hennequin M. Impact of early childhood caries and its treatment under general anesthesia on orofacial function and quality of life: A prospective comparative study. *Med Oral Patol Oral Cir Bucal* 2017; 22:e333-e341.
- » Costa LR, Daher A, Queiroz MG. Early Childhood Caries and Body Mass Index in Young Children from Low Income Families. *Int J Environ Res Public Health* 2013;10: 867-878.
- » Cuadros Fernández C, Armengol Olivares A, Guinot Jimeno F, Lorente Rodríguez AI. Oral rehabilitation of a 4-year-old child with early childhood caries under general anaesthesia: a case report on long-term outcome. *Eur J Paediatr Dent* 2014;229-33.
- » Davis P. Compliance structures and the delivery of health care: The case of dentistry. *Soc Sci Med* 1976;10:329-37.
- » de Souza MC, Harrison M, Marshman Z. Oral health-related quality of life following dental treatment under general anaesthesia for early childhood caries – a UK-based study. *Int J Paediatr Dent* 2017;27:30-36.
- » Edalat A, Abbaszadeh M, Eesvandi M, Heidari A. The Relationship of Severe Early Childhood Caries and Body Mass Index in a Group of 3- to 6-year-old Children in Shiraz. *J Dent (Shiraz)* 2014;15:68-73.
- » Exton MS. Infection-induced anorexia: active host defence strategy. *Appetite* 1997;29:369-83.
- » Ferrazzano GF, Scaravilli MS, Ingenito A. Dental and periodontal health status in Campanian children and relation between caries experience and socio-economic behavioural factors. *Eur J Paediatr Dent* 2006;7:174-8.
- » Ferrazzano GF, Cantile T, Sangianantoni G, Ingenito A. Effectiveness of a motivation method on the oral hygiene of children. *Eur J Paediatr Dent* 2008;9:183-7.
- » Ferrazzano GF, Coda M, Cantile T, Sangianantoni G, Ingenito A. SEM investigation on casein phosphopeptides capability in contrasting cola drinks enamel erosion: an in vitro preliminary study. *Eur J Paediatr Dent* 2012;13:285-8.
- » Ferrazzano GF, Cantile T, Roberto L, Ingenito A, Catania MR, Roscetto E, Palumbo G, Zarelli A, Pollio A. Determination of the in vitro and in vivo antimicrobial activity on salivary Streptococci and Lactobacilli and chemical characterisation of the phenolic content of a *Plantago lanceolata* infusion. *Biomed Res Int* 2015;2015:286817. doi: 10.1155/2015/286817.
- » Ferrazzano GF, Sangianantoni G, Cantile T, Ingenito A. Relationship Between Social and Behavioural Factors and Caries Experience in Schoolchildren in Italy. *Oral Health Prev Dent* 2016;14:55-61.
- » Galeotti A, Garret Bernardin A, D'Antò V, Ferrazzano GF, Gentile T, Viarani V, Cassabgi G, Cantile T. Inhalation Conscious Sedation with Nitrous Oxide and Oxygen as Alternative to General Anesthesia in Precooperative, Fearful, and Disabled Pediatric Dental Patients: A Large Survey on 688 Working Sessions. *Biomed Res Int* 2016; doi: 10.1155/2016/7289310.
- » Garret-Bernardin A, Cantile T, D'Antò V, Galanakis A, Fauxpoint G, Ferrazzano GF, De Rosa S, Vallogini G, Romeo U, Galeotti A. Pain Experience and Behavior Management in Pediatric Dentistry: A Comparison between Traditional Local Anesthesia and the Wand Computerized Delivery System. *Pain Res Manag* 2017; doi: 10.1155/2017/7941238.
- » Gaur S, Nayak R. Underweight in low socioeconomic status preschool children with severe early childhood caries. *J Indian Soc Pedod Prev Dent* 2011; 29:305-9.
- » Hahn CL, Falkler WA Jr. Antibodies in normal and diseased pulps reactive with microorganisms isolated from deep caries. *J Endod* 1992;18:28-31.
- » Jabarifar SE, Eshghi AR, Shabanian M, Ahmad S. Changes in Children's Oral Health Related Quality of Life Following Dental Treatment under General Anesthesia. *Dent Res J (Isfahan)* 2009;6:13-6.
- » Jankauskiene B, Narbutaite J. Changes in oral health-related quality of life among children following dental treatment under general anaesthesia. A systematic review. *Stomatologija* 2010;12(2):60-4.
- » Jankauskiene B, Virtanen JI, Kubilius R, Narbutaite J. Oral health-related quality of life after dental general anaesthesia treatment among children: a follow-up study. *BMC Oral Health* 2014;14:81. doi: 10.1186/1472-6831-14-81.
- » Jankauskienė B, Virtanen JI, Narbutaitė J. Follow-up of children's oral health-related quality of life after dental general anaesthesia treatment. *Acta Odontol Scand* 2017;75:255-261.
- » Kelley KW, Bluthé RM, Dantzer R, Zhou JH, Shen WH, Johnson RW, Broussard SR. Cytokine-induced sickness behavior. *Brain Behav Immun* 2003; 17 Suppl 1:S112-S118.
- » Klaassen MA, Veerkamp JS, Hoogstraten J. Young children's Oral Health-Related Quality of Life and dental fear after treatment under general anaesthesia: a randomized controlled trial. *Eur J Oral Sci* 2009;17:273-8.
- » Lee GH, McGrath C, Yiu CK, King NM. Sensitivity and responsiveness of the Chinese ECHOIS to dental treatment under general anaesthesia. *Community Dent Oral Epidemiol* 2011;39:372-7.
- » Libonati A, Di Taranto V, Mea A, Montemurro E, Gallusi G, Angotti V, Nardi R, Paglia L, Marzo G, Campanella V. Clinical antibacterial effectiveness Healzone Technology after incomplete caries removal. *Eur J Paediatr Dent* 2019;20:73-78.
- » Marchetti E, Mummolo S, Di Mattia J, Casalena F, Di Martino S, Mattei A, Marzo G. Efficacy of essential oil mouthwash with and without alcohol: a 3-day plaque accumulation model. *Trials* 2011;12:262. doi: 10.1186/1745-6215-12-262.
- » Miller J, Vaughan-Williams E, Furlong R, Harrison L. Dental caries and children's weights. *J Epidemiol Community Health* 1982;36:49-52.
- » Pakdaman A, Pourhashemi SJ, Bagheri Ghalesalim M, Ghadimi S, Baradaran-Nakhjavani Y. Comparison of Children's Oral Health Related Quality Of Life Pre- and Post Dental Treatment Under General Anesthesia Using F-ECHOIS Questionnaire. *Iran J Pediatr* 2014;24:121-2.
- » Phillip MA, Hershkovitz EA, Rosenblum HA, Savion IB, Segev YA, Levy JA, Frazer DB. Serum Insulin-Like Growth Factors I and II Are Not Affected by Undernutrition in Children with Nonorganic Failure to Thrive. *Horm Res* 1999;49:76-79.
- » Plitnick LM, Banas JA, Jelley-Gibbs DM, O'neil J, Christian T, Mudzinski SP, Gosse EJ. Inhibition of interleukin-2 by a Gram-positive bacterium, *Streptococcus mutans*. *Immunology* 1998;95:522-528.
- » Sheiham A. Oral health, general health and quality of life. *Bull World Health Organ* 2005; 83:644.
- » Sheiham A. Dental caries affects body weight, growth and quality of life in pre-school children. *Br Dent J* 2006;201:625-626.
- » Thomas CW, Primosch RE. Changes in incremental weight and well-being of children with rampant caries following complete dental rehabilitation. *Pediatr Dent* 2002;24:109-13.
- » Wong S, Anthonappa RP, Ekambaram M, McGrath C, King NM, Winters JC. Quality of life changes in children following emergency dental extractions under general anaesthesia. *Int J Paediatr Dent* 2016; doi: 10.1111/ipd.12241.