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Patients with Special Needs within Treatment under General Anesthesia – Meta-analysis

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Abstract: The study evaluates results obtained from the documentation of patients with special needs, who have undergone treatment under general anesthesia at the pediatric dentistry department. DMFT (decayed, missing, filled teeth) was used for comparison. A sample of 1,836 children from our dental clinic was evaluated. The sample was divided into two groups – special patient and disabled patient populations. A group of 5 years old children was chosen on the bases of WHO guidelines for the setting of the oral health status. A descriptive statistical analysis of the mean standard deviation was conducted with a focus on three factors: sex, age and year. A questionnaire was prepared to compare the oral health habits in the families of the patients. A literary review was conducted to compare the results with other studies from various countries. The meta-analysis using the software MedCalc was done. The DMFT of the patient was counted (disabled DMFT 11.05 – SD 4.82, special patient population 8.8 – SD 3.7) and the descriptive statistics mean standard deviation was calculated. The significant difference between the DMFT of disabled patient and special patient population

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was exerted ($p<0.00003$). It was statistically evaluated that the data gained from the studies and from the WHO as population average for 5 years old children are situated under the minimum limit of the confidence interval for our study. The meta-analysis confirmed the hypothesis that oral health status of the special needs children is worse than in other countries.

Introduction

The discipline of special care dentistry provides complex care to the individuals with wide range of disabling conditions. These patients have psychical or physical disabilities that affect daily life activities and influence the delivery of health care, including dental care (Casamassimo et al., 2004). To provide an effective and safe treatment for these individuals, in many cases, it is necessary to use general anesthesia (GA). However, the need for GA have decreased in recent years, due to the improvements in anti-anxiety medications and conscious sedative techniques (Malamed, 2002).

There remaining indications for using general anesthesia follow indications published by The American Academy of Pediatric Dentistry: Guideline on the use of general anesthesia for pediatric patients. They include patients with certain physical, mental or medically compromising conditions, extremely uncooperative, fearful, anxious or physically resistant children or adolescents with substantial dental needs and no expectation that the behaviour will improve soon (American Academy of Pediatric Dentistry, 2005). All these references may have a negative influence on their oral health status due to poor oral hygiene and also because of the inadequate care in the dentistry department.

Everyday experience at the University Hospital Motol brought about a hypothesis that patients with special needs have the worse oral health status than the healthy ones.

This study was carried out to assess the outcomes of the comprehensive dental treatment provided under GA at the Department of Paediatric Stomatology in University Hospital Motol. The dental care under GA has been monitored since 1991. The study was focused on the period of 2006–2008 and had the following aims:

1. To find out the difference in oral health status of patients with special needs to healthy patients. The DMFT of 5 years old patients was used for comparison. The DMFT describes the amount – the prevalence – of dental caries in an individual. DMFT can numerically express the caries prevalence and is obtained by calculating the number of decayed, missing, filled teeth (Casamassimo et al., 2004).
2. To determine the number of extractions and fillings per a patient treated under GA, referring to age.
3. To detect the oral hygiene habits of special needs patients.
4. To prepare meta-analysis evaluation.

Material and Methods

Long-term observations of the course of treatments under general anesthesia from the years 1991–2008 confirmed the increasing need for the care given to special needs patients.

To ascertain more details on the patients who have undergone the procedure records of patients treated in the years 2006, 2007 and 2008 were analysed. These patients were recommended by their family dentist to the University Hospital Motol. They brought their medical history. Afterwards they were examined by the dentist, and then followed other examinations such as panoramic dental X-ray. The patients with multiple caries were recommended to the treatment under the GA. If any other disease was present, the indication was discussed with the specialist as anesthesiologist, hematologist, surgeon etc.

Table 1 – Number of patients according to diagnosis

Diagnosis	Disease	2006	2007	2008	Length of hospitalization in days
Gastroenterological	coeliac disease, morbus Hirsprung, GER	1	2	2	3.0
Acute	periodontitis, periostitis,	3	6	12	4.2
Immunological	imunodeficits	2	2	4	3.8
Hematological	idiopathic thrombocytopenic purpura, hemophilia	5	1	5	4.9
Polymorbid		6	7	10	4.1
Pulmonological	bronchopulmonal dysplasia, chronic bronchitis	7	5	6	4.1
Genetical	morbus Down, DiGeorge syndrome	9	13	17	4.3
Before orthodontic treatment		7	13	10	6.2
Oncological	morbus Recklinghausen, hepatoblastoma, rhabdomyosarkoma	4	9	11	4.5
Alergological	bronchial asthma, atopic eczema	23	22	23	4.2
Cardiologic	congenital heart defects	36	49	27	3.9
Neurological	psychomotor and mental retardation, epilepsy	49	52	52	4.0
Psychiatrical	depression, attention deficit hyperactivity disorders	7	6	7	3.6
Anxious	anxiosity	128	105	61	4.1
Other	strabism, myopia	11	10	5	4.2

The data were collected with a written consent, which was signed before the procedure. A cohort of 1,836 children was treated in the years 2006, 2007 and 2008. These children were divided into two groups. Group one consisted of disabled patients: disabilities is an umbrella term, covering impairments, activity limitations, and participation restrictions (Wong, 1997). This term is used for the patients with special medical conditions that can effect dental treatment. These medical problems as cardiological, hematological, and oncological, etc. can compromise a child's medical management and prognosis (WHO: Global Oral Health: Caries Prevalence: DMFT and DMFS; http://www.whocollab.od.mah.se/expl/orhdmft.html). Group one had 1,005 members. Majority of them, 634 (63%), were males and the rest were, 371 (37%), females. They were divided into 14 groups based on their diagnosis. These patients were admitted for overnight stay. They were usually discharged during the next few days. Discharge time depended on their disability (Table 1).

Group two is defined as special patient population. This term describes those patients who are outside of the description of an average, healthy child, and includes individuals with significant psychological conditions and those who are fearful or phobic (Dougherty, 2009). These patients must be treated under general anesthesia due to anxiety and incorporation. Group two consists of 831 children patients. It was composed of 489 (59%) males and 342 (41%) females. They were admitted for overnight stay.

Due to the recommendation of the third edition of *"Oral Health Surveys – Basic Methods"*, Geneva 1987, it was selected the age group of 5 years old children. This age is of interest in relation to levels of caries in the primary dentition which exhibit changes over a shorter time may span than the permanent dentition at other index ages (Caputo, 2009). Average DMFT was counted for every group.

The oral health status was compared between group one and group two. A method of descriptive statistics, analysis of variance with three factors (sex, age and year of procedure), was used to find the contrast between groups.

Before the treatment a health care questionnaire was voluntarily filled out by the legal representatives. The questionnaires were compiled to find out the difference between oral health care provided by the families of the disabled and special patient populations. The questions were focused on the education of the parents, breast-feeding and consumption of beverages, the symptoms of the multiple caries as pain, teeth colour changes, frequency of teeth brushing and brand of tooth paste they use. The last questions were asked to reveal who instructed the parents about oral health care and during which visit of their dentist was the child recommended to receive treatment under general anesthesia. Total of 247 questionnaires were collected.

It was necessary to compare our results with those in other studies. The studies were found thanks to the PubMed database through the key words: disabled – special needs patient – DMFT – general anesthesia. Six relevant studies were

found: Ohito et al. (1993), Desai et al. (2001), Alavi et al. (2006), Ivancić Jokić et al. (2007), de Jongh et al. (2008), Jain et al. (2008). It was used in a meta-analysis for the studies with a continuous measure (comparison of means between treated cases and controls). Statistical software MedCalc which uses Hedges g statistic as a formulation for the standardized mean difference under the fixed and random effects model was used. The heterogeneity statistic was then incorporated to calculate the summary standardized mean difference under the random effects model (DerSimonian and Laird). A review from literature was prepared. Eight international studies were selected. Three of them (Croatia, Kenya, UK) had to be suspended because of the absence of the standard deviation in the study (Table 2). The DMFT from the national studies which uses the WHO for the determination of oral health status was also found (Table 3). From the studies of selected countries chosen for the meta-analysis some of them were suspended because of the different criteria for the patient selection (India) and for the absence of the standard deviation (The Netherlands). Then the table for the meta-analysis was prepared (Table 4).

Table 2 – Literature review (selected studies)

No.	Study	Authors	Group	DMFT	SD
1.	A study of the dental treatment needs of children with disabilities in Melbourne, Australia	Desai et al.	150	2.5	3.1
2.	Dental caries in disabled children/Croatia	Ivancić Jokić et al.	80	1.41	
3.	Dentition status and treatment needs among children with impaired hearing attending a special school for the deaf and mute in Udaipur, India	Jain et al.	18	2.17	1.98
4.	The prevalence of dental caries in 5–18-year-old insulin-dependent diabetics of fares province, southern Iran	Alavi et al.	50	9.64	4.64
5.	Dental caries, gingivitis and dental plaque in handicapped children in Nairobi, Kenya	Ohito et al.	449	0.8	
6.	Oral health status, treatment needs, and obstacles to dental care among no institutionalized children with severe mental disabilities in The Netherlands	de Jongh et al.	61	3	3.1
7.	Dental disease and current treatment needs in a group of physically handicapped children/UK	Nunn et al.	139	0.9	
8.	Oral health status and treatment needs of children and young adults attending a day centre for individuals with special health care needs/Nigeria	Oredugba and Akindayomi	13	1.46	2.06
9.	Czech Republic		1005	11.1	4.8

Results

A total of 16,816 teeth were treated. Table 5 representing the average number of extractions and fillings per patient refers to the patient's age show that there is a bigger variety of age of disabled patients (2–18) and special patient's population (2–11) because of the possibilities of the anesthesiologist. The special patients

Table 3 – WHO: Global Oral Health: Caries Prevalence: DMFT

Country	DMFT/source WHO	Number of patients	SD
Australia	1.8	10 904	3.05
Croatia	7.7	74	4.96
Czech Rep.	2.6	3337	1.82
India	3.5	600	2.56
Iran	3.4	247	2.65
Kenya	3.0	304	n.a.
Netherlands	1.5	218	n.a.
UK	1.6	176 781	1.02
Nigeria	0.3	423	0.92

n.a. – non available

Table 4 – The studies included to the meta-analysis

	Study Group		WHO group	
Country	Number of patients	SD	Number of patients	SD
Australia	150	3.10	10 904	3.50
Czech Republic	1005	4.80	3337	1.82
Iran	50	4.64	247	2.65
Nigeria	13	2.06	423	0.92

Table 5 – Characteristics of the group and average number of extractions and fillings in the age group

	Disabled		Special patient population	
Gender	N	(%)	N	(%)
male	634	63	489	59
female	371	37	342	41
total	1005	100	831	100
Age (years) range	Extractions	Fillings	Extractions	Fillings
2–4	8.4	1.6	5.9	2.1
5	9.9	1.1	6.6	1.7
6–11	7.3	1.7	5.8	1.6
12	5.3	3.1	n.a.	n.a.
13–14	6.4	3.2	n.a.	n.a.
15	6.5	3.5	n.a.	n.a.
16–18	7.9	8.6	n.a.	n.a.

n.a. – non available

belong to the group of ASA I (a normal healthy patient) with a maximum weigh 30 kg. The extractions number outweighs the number of fillings at all groups of patients.

For the confrontation it was counted the DMFT of 5 years old patients. This group has 281 members. 85 are disabled patient (DMFT 11.1) and 196 belong to the special patient population (DMFT 8.8). The significant difference between group one and group two ($p<0.00003$) was identified. The analysis of dispersion with three factors: age, sex and year were used. There was no difference between males and females and no changes from year to year.

247 completed questionnaires (76 by the legal representatives of the handicapped patients and 171 by the legal representatives of the healthy patients) were collected before the treatment under general anesthesia was conducted. No differences were found in majority of the responses. Only in two questions – in the length of breast-feeding and in the age of first visit to the dentist – a difference was found. 55% of the disabled patients were breast-fed for less than three months but 25% of the healthy patients were breast-fed for less than three months. Another difference was found when comparing the first visit to the dentist. 39% of disabled patients did not visit their dentist before the third year of age and 39% not before the fifth year age. 63% of the patients from the group of special needs population

Table 6 – Meta-analysis results for continuous parameter – MedCalc

Country	N1	N2	Total	SMD	95% CI
Australia	150	10 904	11 054	0.229	0.0683–0.391
Czech Republic	1005	3337	4342	3.028	2.9330–3.123
Iran	50	247	297	2.027	1.6800–2.373
Nigeria	13	423	436	1.194	0.6350–1.753
Total (fixed effects)	1218	14 911	16 129	2.269	2.1900–2.348
Total (random effects)	1218	14 911	16 129	1.622	–0.0945–3.338

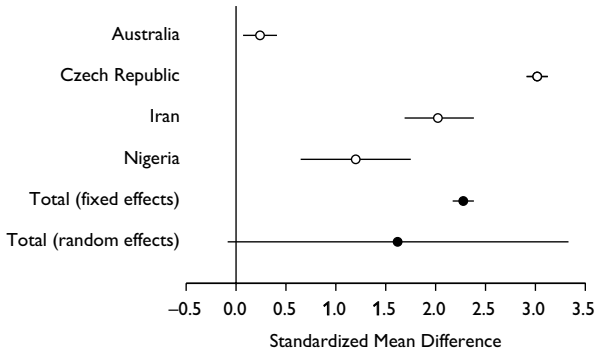

Figure 1 – Graphical demonstration of the results of the meta-analysis.

did not visit the doctor until 3 years of age and just 9% of them waited 5 years to visit the dentist.

The meta-analysis was done using the statistical software MedCalc. The program MedCalc lists the results of the individual studies: number of positive cases, total number of cases, the standardized mean difference (SMD) with 95% CI.

The total standardized mean difference (SMD) with 95% CI is given both for the fixed effects model and the random effects model.

Cohen's rule of thumb for interpretation of the SMD statistic is: a value of 0.2 indicates a small effect, a value of 0.5 indicates a medium effect and a value of 0.8 or more indicates a large effect. In our study is this value for total fixed effects 2.269 and for total random effects 1.622.

Interpretation of the 95% CI is: if the value 0 is not inside the 95% CI, then the effect is statistically significant at the 5% level ($P<0.05$). In our study the value of 95% CI for the total fixed effect is 2.190 to 2.348, also significant, the value of 95% CI for the total random effect is –0.0945 to 3.38, also not significant, but borderline value.

The random effects model will tend to give a more conservative estimate (i.e. with wider confidence interval), but the results from the two models usually agree where there is no heterogeneity. If the test of heterogeneity is statistically significant ($P<0.05$), then more emphasis should be placed on the random effects model (Table 6).

Fixed effect confirmed significantly that patients with special needs in all groups had higher DMFT then healthy ones (Figure 1). Total random effect has to be considered as the borderline because of the difference and heterogeneity of the studies. SMD value (1.622) is high but random effect is not significant.

Discussion

It is known from every day experiences, that the special patient population and disabled children require special treatment, which is not easy to ensure because it depends on the compliance of the anesthesiologist, dentist and the parents of the patient. It is necessary, in some cases, to conduct treatment under GA. It offers a fast, safe, comfortable and convenient method for the patient and the dentist. The risks implicated from GA are a necessity of the specialized department and expensiveness. The studies from the 1987, 1993, 1998 and 2001 (Krejsa and Mrklas, 1995; Lencova et al., 2002) show that the oral health status of 5-year-old Czech children without disabilities becomes worse (DMFT 2.72, 2.72, 3.3, 3.7). This study focused on the special patient population because the Department of Paediatric Stomatology in University Hospital Motol is highly specialized in the treatment of patients with the most severe diagnoses.

Everyday experience at the University Hospital Motol brought about a hypothesis that the disabled children and the special patient population have worse oral health status than patients without disabilities. The study uncovered

alarming evidence proving the bad oral health status for both groups of patients in the Czech Republic. The results of the study were compared with studies using similar criteria (Table 2). Desai et al. (2001) attributes this to global factors (medications, diet and inadequate oral hygiene) and local factors such as malocclusion lack of normal masticatory functions and bruxism. Desai also says that these children become less intensively cared for than healthily children (only one of 210 children with malocclusion undergone orthodontic treatment). Also those children requiring teeth brushing assistance had poorer oral hygiene. Based on the study from Ivancić Jokić et al. (2007) this groups needs to have regular dental service before the age of 5 years. This study supports Ivancić Jokićs' statement with the results from the elaboration of questionnaires. Jain imputes this to negligence on the part of parents and school authorities in obtaining dental treatment for these children. Alavi et al. (2006) reported that diabetic children had higher DMFT due to level of oral hygiene ($P<0.05$). The data gained from the studies was evaluated statistically (5, 6, 10, 12, 13, 14, 15) and the WHO as population average for 5 years old children are situated under the minimum limit of the confidence interval of our study.

The study shows that in all groups, no difference in age or sex, the number of extractions outnumbered the number of fillings. This is an evidence supporting the view that the children are coming for the examination late, already with severe lesions which cannot be treated conservatively. This data were ascertained from the questionnaires that stated that 39% of disabled children did not visit their dentist before the 3rd year of age and another 39% did not visit dentist before the 5th year of age. 63% of the patients from the group of special needs population did not come to the dentist until reaching 3 years of age. From the authors point of view the parents of disabled patients rely on the care of their children's impairments to the dentistry care. There is no doubt that high quality dental care improves a patient's quality of life and avoiding unnecessary pain and along with looking from the medical point of view that there are some risks with the use of GA. Desai et al. recommends 8 basic precautions for the betterment of dental care.

To improve the bad oral health status of children with special needs, there is a requirement for better education of all medical doctors, dentist and parents about the possibilities of better cooperation to help improve the quality of life of the children.

Conclusion

According to the presented results, the oral health status of Czech patients with special needs is significantly low. This results support the necessity of better preventive care of disabled and special patient's population in the Czech Republic. Further betterment is mandatory in improving of preventive measurements and promoting oral health particularly in children with systemic disease.

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