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SUBSTANTIATION OF A SAFE PERIOD OF TIME FOR THE ORAL CAVITY SANITATION UNDER GENERAL ANESTHESIA IN CHILDREN AGED 12-18 YEARS

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The article substantiates a safe period of time for the sanitation of the oral cavity in an outpatient setting under general anesthesia in children aged 12-18 years in order to prevent the occurrence of cognitive dysfunction of the brain against the background of hypoxic lesions. The results of the study revealed: in order to prevent the occurrence of brain hypoxia during dental sanitation of the oral cavity in conditions of general anesthesia (without intubation), children aged 12 to 18 years should spend within 60 ± 15 minutes; the contraindication for the planned sanitation of the oral cavity in conditions of general anesthesia (without intubation) is the absence of a history of acute respiratory diseases for at least 2 weeks; if there is a history of acute respiratory disease in less than 2 weeks and an acute dental need, ambulance in general anesthetic conditions (without intubation) is possible within ≤ 20 min.

Key words: cerebral oximetry, SpO₂, rSO₂, general anesthesia.

The work is a fragment of the research projects: "Diagnosis, treatment and prevention of diseases of the hard tissues of the teeth at different stages of their development in children", state registration No. 0116U000122, and "Features of the clinic, diagnosis, treatment and prevention of dental diseases in children with developmental disabilities", state registration No. 0119U100454.

The high intensity and prevalence of dental caries in the pediatric population, create unfavorable conditions for maintaining the psychological balance of the child at the dental attendance, and hence its further mental development. Most children during the dentist's attendance are accompanied by negative stress, which can lead to impaired cognitive function of the brain [7, 8].

According to various authors, about 70% of school-age children and about 90.9% of preschool children require psychological correction before dental intervention [6].

The result of the absence of psychological contact between the dentist and a small patient is the unreasonable expansion of indications for the application of general anesthesia in the oral cavity sanitation in children of all ages [3].

In order to preserve the child's psychological sphere, dentists sometimes underestimate the risks of general anesthesia. Today, a large number of scientific papers are devoted to the study of the general anesthesia negative impact on cognitive function in patients of all ages [1, 9, 10, 11]. One of the first places in the statistics of anesthesiologic complications is occupied by cognitive disorders in hypoxic brain lesions [1, 4, 13]. Therefore, in order to prevent the occurrence of cognitive impairment of the brain against the background of its hypoxic lesions during the oral cavity sanitation in children under conditions of general anesthesia, along with providing adequate indicators of vital functions of the organism, such as heart rate, blood pressure, pulse oximetry, oxygen status of the brain. A large number of methods for the evaluation of cerebral hemodynamics have been described in the literature [4, 5]. However, there is no data on the study of brain oxygen status in children during outpatient interventions under general anesthesia, which may be important to prevent cognitive impairment in children against hypoxic brain damage in dental intervention.

The purpose of the study was to establish a safe period of time for the oral cavity sanitation in outpatient conditions under general anesthesia in children aged 12-18 years in order to prevent the occurrence of cognitive dysfunction of the brain against the background of hypoxic lesions.

Materials and methods. Sanitation of the oral cavity in the conditions of general anesthesia was carried out in 30 children aged from 12 to 18 years on the basis of the Dental Medical Center at the Bogomolets National Medical University. According to the classification of temperaments (Thomas and Chess, 1997), this group of children included: 19 children with "difficult" temperament and 11 children – with "slow-to-warm-up" temperament.

Assessment of the oxygen status of the brain during the oral cavity sanitation under the conditions of general anesthesia was performed using a non-invasive method of neuromonitoring – cerebral oximetry (apparatus for arterial blood gas monitoring: 4-channel regional oximeter with EQUANOX™ technology, Bluetooth wireless technology and 232 wireless technology (Model 7600) (State Registration Certificate No. 12580/2013. Manufacturer: Nonin Medical, Inc., USA).

To predict cognitive changes against the background of hypoxic brain disorders, we used the results of J. Meixensberger 1998 [2].

Results of the study and their discussion. Dynamics of vital functions indices monitoring of an organism in children of different temperaments at the age from 12 to 18 years are presented in table. 1.

Table 1

Dynamics of vital functions indices monitoring of an organism in children aged 12-18 years

Stages of operation		Before the induction	Induction	Treatment	After treatment	Overall indices	
Temperament	Monitoring indicators						
"Difficult" (n=19)	rSO2 (%)	68.26±1.56	73.31±1.89	75.17±2.21	75.46±1.56	73.05±1.03	
	SpO2 (%)	96.11±1.05	97.32±1.29	96.62±2.15	95.37±1.3	96.35±1.07	
	BP (mmHg)	SBP	124.3±2.58	114.2±5.5	112.1±5.01	108.2±1.65	114.69±1.84
		DBP	81.11±1.59	75.05±3.37	72.26±3.63	72.21±3.26	75.16±2.47
	HR (bpm)	110.9±5.59	105.6±4.08	98.11±1.24	96.84±1.21	102.9±2.39	
"Slow-to-warm-up" (n=11)	rSO2 (%)	70.18±2.52	76.34±0.85	76.48±1.62	77.49±0.55	75.12±1.03	
	SpO2 (%)	95.62±0.8	96.18±1.33	96.65±1.19	96.64±0.5	96.27±0.74	
	BP (mmHg)	SBP	112.2±1.99	110.5±1.92	111.8±2.09	108.9±0.94	113.1±1.11
		DBP	80.09±1.81	72.45±1.97	71.64±3.04	72±3.66	74.05±2.05
	HR (bpm)	108.4±1.21	101.6±3.07	98.36±1.74	96.73±1.01	101.27±1.4	
Overall indices (n=30)	rSO2 (%)	68.97±2.14	74.42±2.16	75.65±2.09	76.21±1.39	73.81±1.44	
	SpO2 (%)	95.93±0.98	96.9±1.39	96.63±1.83	95.83±1.23	96.32±0.95	
	BP (mmHg)	SBP	123.1±2.79	112.8±4.48	112±4.13	108.5±1.45	114.11±1.77
		DBP	80.73±1.72	74.1±3.17	72.03±3.39	72.13±3.35	74.75±2.35
	HR (bpm)	110±4.64	104.1±4.17	98.2±1.42	96.8±1.13	102.28±2.16	

As it can be seen from the table. 1, there was a decrease in HR and BP in the preoperative period. These figures were 110±4.64 b.p.m. and 123.1±2.79/80.73±1.72 mm.Hg, respectively.

The values of cerebral oximetry were significantly observed in the preoperative period (rSO2=68.97%±2.14), compared with the operative periods (rSO2=75.65±2.09) in the presence of equally exact pulse oximetry indices. SpO2 indices left 95.93%±0.98 and 96.63%±1.83 respectively.

Thus, it can be argued that general anesthesia in children with dental intervention was a kind of psychological "protection" of higher nervous activity from the stress effects.

The results of cerebral oximetry during dental intervention in conditions of general anesthesia in children aged 12-18 years are presented in fig. 1.

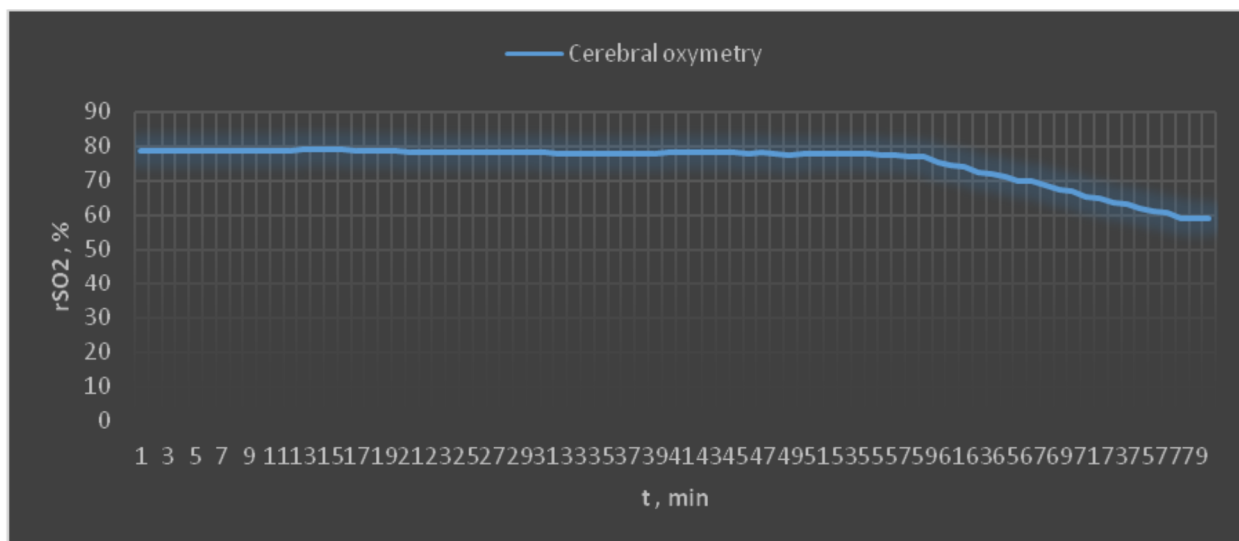


Fig. 1. Indices of rSO2 in children aged 12-18 years in the period of oral cavity sanitation under general anesthesia (without intubation).

The decrease in rSO2 started from the 60th minute. The minimum rSO2 value was 60.59%±0.58, which is within the normal range, and was 77 minutes (table 2).

The maximum value of rSO2 was 79.11%±2.02, accounting to 13; 15 min. and did not exceed the permissible maximum value (90.78%) (table 2).

Thus, the progressive decrease in cerebral oximetry indicated that in order to avoid complications after treatment, children aged 12 to 18 years could be rehabilitated by oral anesthesia (without intubation) within 60±15 min.

Min and max rSO₂ indices in children aged 12-18 years

Mean value	“Difficult”	“Slow-to-warm-up”
n =30	n=19	n=11
max=90.78%	max=90.2%	max=91.74%
75.65% (20%=15.13%)	75.17% (20%=15.03%)	76.48% (20%=15.26%)
min=60.52%	min=60.14%	min=61.22%

Respiratory complications were observed in 3.33% of children during dental invasion. The results of rSO₂ and their correlation with SpO₂ are presented in fig. 2, 4.

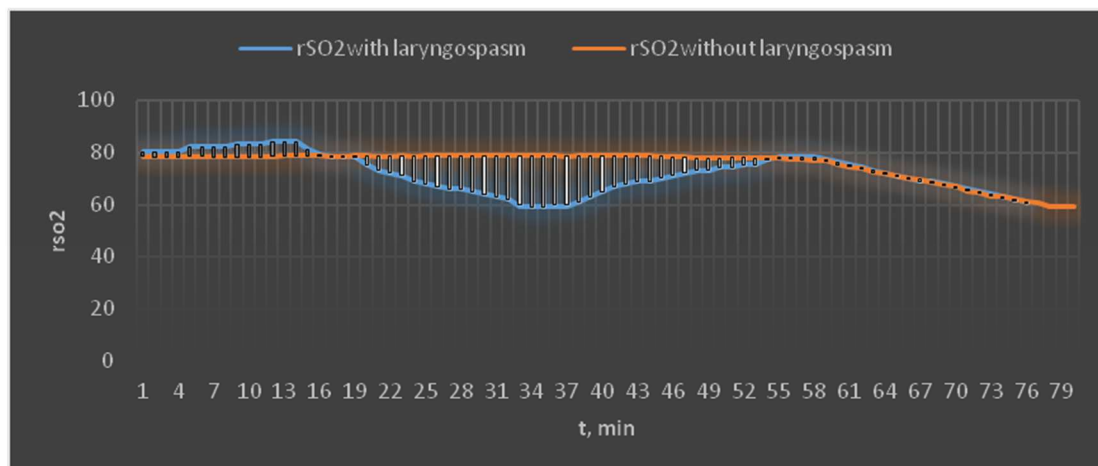


Fig. 2. Dynamics of rSO₂ in laryngospasms during the oral cavity sanitation under general anesthesia (without intubation) in children aged 12-18 years.

The mean rSO₂ value in children with laryngospasm during oral cavity sanitation under general anesthetic conditions was $72\% \pm 7.27$ – decreased by 4.82% relative to the mean rSO₂ of the relevant age group ($rSO_2 = 75.65\% \pm 2.09$). Decreasing rSO₂ from 20-53min. (<20 min) was 6.12% ($rSO_2 = 67.59\% \pm 5.16$). The maximum decrease was observed at 34-35min. ($rSO_2 = 59\% \pm 0.01$), which is 18.05% of the total value and 12.71% of the rSO₂ index directly in laryngospasm.

Among children with complications in the form of laryngospasm during the oral cavity sanitation under the conditions of general anesthesia had a history of 100% less than 2 weeks after complete recovery of the acute respiratory disease (ARD). To study the effect of respiratory tract inflammation on the possibility of complications, we compared the group of children with a history of ARD ≤ 2 weeks with the group of children who had a history of ARD for ≥ 2 weeks but ≤ 4 weeks (16.67%).

The results of this analysis are presented in fig. 3.

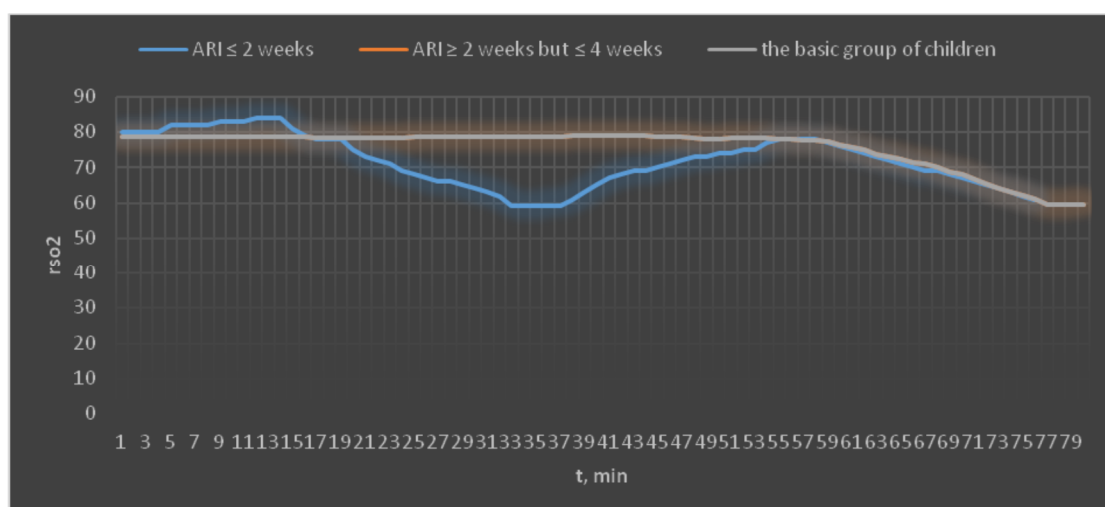


Fig. 3. Indices of rSO₂ in children 12-18 years of age with ARI ≤ 2 weeks (I) and ARI of ≥ 2 weeks but ≤ 4 weeks (II) and their correlation with baseline groups of children (III).

We noted the decrease in rSO₂ ($72\% \pm 7.27$) by 4.28% in Group I, while the rSO₂ in Groups II and III were not significantly different and were $75.78\% \pm 5.66$ and $75.65\% \pm 2.09$ respectively.

In the study of indices of cerebral oximetry and pulse oximetry, no correlation of these indices in time and magnitude was found. The mean value of SpO₂=95.12%±3.34 with the mean value for this age group being 96.63%±1.83 (fig. 4).

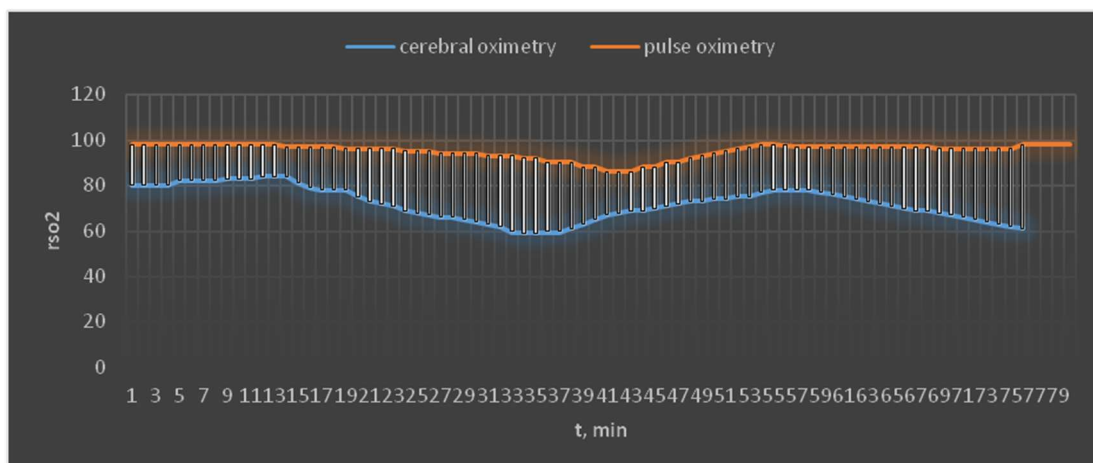


Fig. 4. Correlation of rSO₂ and SpO₂ in complications during oral remediation under general anesthesia (without intubation) in children aged 12-18 years.

Reduction of SpO₂ (88.33%±1.67) in complications occurred from 35 min. to 47 minutes (<20 min.) by 8.59%, which is 15 minutes later respect to rSO₂ (20-53 min.) and almost twice the magnitude (rSO₂ decreased by 4.82%).

In general, our results are consistent with the data of other researchers [1, 4, 5]. However, in our aspect, the problem of oral sanitation in children under general anesthesia has been studied only partially [9]. We tried to find the optimal period of time for general anesthesia of children aged 12-18 years under in an outpatient setting to prevent the occurrence of cognitive dysfunction in the background of cerebral hypoxia. However, there is data with which our study is partially consistent [4].

Conclusions

1. In order to prevent the occurrence of brain hypoxia during dental sanitation of the oral cavity under the conditions of general anesthesia (without intubation), children aged 12 to 18 years should spend within 60±15 minutes.
2. The contraindication for the planned sanitation of the oral cavity in conditions of general anesthesia (without intubation) is the absence of a history of acute respiratory diseases for at least 2 weeks.
3. If there is a history of acute respiratory disease in less than 2 weeks and an acute dental need, ambulance in general anesthetic conditions (without intubation) is possible within ≤20 min.
4. SpO₂ indices do not correlate with rSO₂ values.
5. The method of cerebral oximetry is more sensual than the method of pulse oximetry, which makes it possible to detect changes in oxygen balance of the cerebral cortex in a timely manner and to maintain it in time.

Prospects for further research lie in the fact that to compare the dynamics of cerebral oximetry in children of different ages during dental interventions under general anesthesia in an outpatient setting and during various dental outpatient manipulations. According to the results of the study, establish a safe period of time for different dental manipulations for different types of dental sanitation in children of different ages, in order to determine the indications for dental intervention in conditions of general anesthesia on an outpatient basis.

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Реферати

ОБГРУНТУВАННЯ БЕЗПЕЧНОГО ПРОМІЖКУ ЧАСУ ПРОВЕДЕННЯ САНАЦІЇ ПОРОЖНИНИ РОТА ПІД ЗАГАЛЬНИМ ЗНЕБОЛЕННЯМ У ДІТЕЙ ВІКОМ 12-18 РОКІВ

Коваль О. І.

В статті обгрунтовано безпечний проміжок часу проведення санації порожнини рота в амбулаторних умовах під загальним знеболенням у дітей віком 12-18 років з метою попередження виникнення когнітивних дисфункцій головного мозку на фоні гіпоксичних уражень. За результатами дослідження встановлено: з метою попередження виникнення гіпоксії головного мозку при проведенні стоматологічної санації порожнини рота в умовах загального знеболення (без інтубації) дітям віком від 12-ти до 18-ти років варто проводити в межах 60 ± 15 хв.; протипоказанням для планового проведення санації порожнини рота в умовах загального знеболення (без інтубації) є відсутність в анамнезі гострих респіраторних захворювань не менш ніж за 2 тижні; при наявності в анамнезі гострих респіраторних захворювань менш ніж за 2 тижні та гострою стоматологічною потребою, надання швидкої допомоги в умовах загального знеболення (без інтубації) можливо в межах ≤ 20 хв.

Ключові слова: церебральна оксиметрія, SpO₂, rSO₂, загальне знеболення.

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ОБОСНОВАНИЕ БЕЗОПАСНОГО ПРОМЕЖУТКА ВРЕМЕНИ ПРОВЕДЕНИЯ САНАЦИИ ПОЛОСТИ РТА ПОД ОБЩИМ ОБЕЗБОЛИВАНИЕМ У ДЕТЕЙ В ВОЗРАСТЕ 12-18 ЛЕТ

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В статье обоснован безопасный промежуток времени при проведении санации полости рта в амбулаторных условиях под общим обезболиванием у детей в возрасте 12-18 лет с целью предупреждения возникновения когнитивных дисфункций головного мозга на фоне гипоксических поражений. По результатам обследования установлено: с целью предупреждения возникновения гипоксии головного мозга стоматологическую санацию полости рта в условиях общего обезболивания (без интубации) детям в возрасте от 12-ти до 18-ти лет следует проводить в пределах 60 ± 15 мин. Противопоказанием для планового проведения санации полости рта в условиях общего обезболивания (без интубации) является отсутствие в анамнезе острых респираторных заболеваний не менее чем за 2 недели. При наличии в анамнезе острых респираторных заболеваний менее чем за 2 недели и острой стоматологической необходимости оказание скорой помощи в условиях общего обезболивания (без интубации) возможно в пределах ≤ 20 мин.

Ключевые слова: церебральная оксиметрия, SpO₂, rSO₂, общее обезболивание.

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APPLICATION OF NANOCRYSTALS IN TREATMENT OF CHRONIC APICAL PERIODONTITIS

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The use of nanocrystals for the treatment of chronic apical periodontitis is the current level of nanomedicine. We examined and treated 11 patients aged 17 to 67 years for aggravated and chronic apical periodontitis using the author's method of using phosphate buffer. An assessment of clinical and radiological data was carried out, which confirmed the process of restoration of periapical tissues in 11 patients. She showed that the regeneration of the apical and adjacent areas of the periodontal in 10 cases had a positive trend already after 29-30 days from the start of treatment; in 1 case the downward dynamics of recovery after 40 days from the start of treatment due to the presence of somatic pathology in the patient. The proposed method for the treatment of chronic apical periodontitis on the basis of the obtained treatment results requires further study in the long term with the aim of widespread implementation in practical dentistry.

Key words: treatment of chronic apical periodontitis, single crystals, phosphate buffer.

The work is a fragment of the research project "Application of modern technologies in diagnostics and treatment for rehabilitation of dental patients by orthopedic methods", state registration No. 0117U004778.

Nanomedicine, a novel branch of medicine, applies nanotechnological advances for the treatment of various diseases in dental patients with control of biological activity of the outcomes. Currently, for non-cellular strategy of tissue engineering in the treatment of apical periodontitis, application of nanocarriers is crucial [7, 12]. In endodontics, the diverse solutions, including 10%, 15%, 40% citric acid, are used at the stage of preparation of root canals by mechanical, instrumental and chemical removal of organic debris,