

INFLUENCE OF DAMAGE OF LOWER ALVEOLAR NERVE AFTER REMOVAL OF IMPACTED LOWER MOLARS TO LEVEL ON MARKERS OF SURGICAL STRESS

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Abstract

Post-traumatic stress disorder, caused by inflammation and swelling of the facial soft tissues, pain syndrome, trismus, sensory violation of the functions of the lower alveolar nerve (LAN) and / or tongue nerves, may occur after the complex removal of deeply impacted lower third molars (ILTM) in patients. An important role in the appearance of anxiety and psychoemotional stress belongs to the subjective and objective symptoms of neuropathy.

The study of the effect of clinical symptoms of neuropathy of the LAN on the appearance of anxiety and growth of cortisol, as a marker of the severity of the body's stress response, in the oral fluid of patients after the removal of ILTM was conducted.

The observation was conducted in 30 operated patients for ILTM. For the first postoperative day, 17 patients (56,7%) had a mild degree, and 10 (33,3%) had a moderate degree of neuropathy of the LAN. The level of anxiety according to the HADS scale was elevated in 6 patients (20,0 %) with a mild degree of neuropathy of the LAN ($8,5 \pm 0,8$ points), and in 7 patients (23,3 %) with moderate degree of neuropathy revealed clinically expressed symptoms of anxiety ($11,7 \pm 0,8$ points). During the 3rd postoperative day, the number of patients with elevated anxiety increased to 8 (26,7 %) in patients with a mild degree of neuropathy of the LAN and in all patients with a moderate degree of neuropathy of the nerve, $\chi^2 = 12,34$ ($p < 0,01$). On the 1st day of postoperative period, the level of cortisol increased in 5 (16,7%) patients with subclinical manifestations of anxiety and in 7 patients (23,3%) with clinical manifestations ($\chi^2 = 26,53$, $p < 0,001$). On the 3rd day cortisol was elevated in 7 people (23,3%) with subclinical manifestations of anxiety and in 10 patients (33,3%) - with clinical manifestations ($\chi^2 = 26,44$, $p < 0,001$).

The appearance of clinical symptoms of neuropathy in the LAN causes the appearance of psychoemotional stress (anxiety) of varying degrees of severity in them, which affects the growth of cortisol levels in the oral liquid.

Key words: impacted lower third molars, lower alveolar nerve, neuropathy, anxiety, cortisol.

Introduction. In maxillofacial surgery removal of impacted lower third molars (ILTM) remains one of the most common tooth-maxillary operations (1,2). After their removal, posttraumatic stress disorder (3) may arise due to inflammation and swelling of the soft facial tissues, pain syndrome, trismus, sensory impairment of the functions of the inferior alveolar and / or lingual nerves and other consequences of surgical alteration of the mandible and

adjacent tissues (2,4-6). Despite the prior awareness of patients about the course of the operation and the postoperative period, the appearance of the above clinical symptoms often causes anxiety, psycho-emotional stress (3,7-10). However, in the professional literature we did not find data on the effect and significance of the inferior alveolar nerve (IAN) damage factor on the appearance of excitation and anxiety in

patients as manifestations of emotional stress in them.

The marker of the severity of the stress-reaction of the body traditionally serves cortisol (11-13). The level of cortisol in saliva directly correlates with the level of cortisol in blood serum (11). Sampling of saliva is a non-invasive method, therefore it is acceptable among dental patients.

The aim of the study: was to investigate the effect of clinical symptoms of lower alveolar nerve neuropathy on the emergence of anxiety and the increase in cortisol levels in the oral fluid of patients after the removal of ILTM.

Material and method. Surgical treatment of 30 patients aged 16-28 years was conducted on the deep impaction of the lower third molar (severy level of complexity according to Pederson rate (14,15). Clinical studies were conducted in the surgical department of the Dental Medical Center of the Danylo Halytsky National Medical University for the period from 2017 to 2019. The protocol used in this study conformed to the tenets of the Declaration of Helsinki and was approved by the Ethics Committee of the Danylo Halytsky Lviv National Medical University.

All patients were somatic-healthy. The course of post-operative rehabilitation was evaluated for the severity of the pain syndrome, swelling of the soft facial tissues, the degree of inflammatory muscle contracture of the masticatory muscles. The level of anxiety in patients was determined using the hospital scale of anxiety and depression (HADS) (16).

The degree of damage to the IAN was detected by measuring the electrical excitatuin of the pulp (electro-odonto-diagnosis «EOD») of the canine on the

corresponding side of the mandible using a portable digital electroodontometer "Pulptester" (Taiwan) and electric potentials (EP) of the facial skin in the projection of the mental aperture using the method of Syrak S.V. and et al. 2006 (17). At values of the EOD index of canines 12-25 μA and EP of facial skin 45-55 μA , a temporary violation of the conductivity of the nerve (a mild degree of damage) was diagnosed, with the EOD of these teeth 26-50 μA and EP of the skin 55-80 μA – the damage of nerve segment (moderate degree of damage) and with EOD 51-100 μA and EP of facial skin 80-150 μA - complete termination of conduction of the nerve trunk (severe degree of damage).

The intensity, character, and frequency of subjective and objective neuropathy symptoms in patients were studied according to the Neuropathy Total Symptom Score NTSS-9 (18), according to which the mild severity of the symptom was evaluated at 1-2 points, moderate - 2-3 points, strong - 3, and also frequently arising symptom - 0,33 points, constant symptom - 0,66 points. The determination of cortisol in the oral liquid was carried out by method ELISA on the 1st and 3rd day between 8 a.m. and 9 a.m. (taking into account the circadian rhythms of this hormonal index) using the analyzer and test system Euroimmun (Germany).

Statistical processing of the results of the study was carried out by calculating the arithmetic mean and mean square deviation. For particle comparison, the Pearson x-square criterion (χ^2) is used. The difference was considered to be significant at $p < 0,05$. The calculations are carried out in the software environment R.

Results. Due to surgical trauma, all patients under observation in the postoperative period had pain syndrome of varying intensity, swelling of soft facial tissues, inflammatory contracture of masticatory muscles. In 27 patients there were subjective and objective symptoms of neuropathy of IAN, in 3 patients, clinical manifestations of this nerve damage were absent. Thus, in the first postoperative day, 17 patients (56,7 %) had a mild degree of neuropathy of the IAN, and EOD indices of canines were $20,5 \pm 4,5 \mu\text{A}$ and EP of the facial skin of the skin was $51,0 \pm 3,8 \mu\text{A}$. According to the modified scale NTSS-9, the symptoms of neuropathy in the IAN patients were evaluated at $4,0 \pm 1,5$ points. Prevailing were weakly expressed or moderate symptoms of paresthesia and tingling of the lower lip and teeth, periodic appearance of dragging pain in the lesions. In 10 patients (33,3 %) there was a moderate degree of IAN damage: the EOD of the canines was $36,9 \pm 8,5 \mu\text{A}$ and EP of the skin in the projection of the mental aperture of $65,7 \pm 9,1 \mu\text{A}$.

According to the modified NTSS-9 scale, patients were assessed at $8,4 \pm 1,1$ points. The signs of the IAN were characterized by symptoms of numbness of the lower lip and teeth and the frequent occurrence of pain in the lesions. The level of anxiety according to the scale of HADS was elevated in 6 (20,0 %) patients with a mild degree of neuropathy of the IAN ($8,5 \pm 0,8$ points), and in 7 (23,3 %) patients with moderate degree of neuropathy, clinically expressed symptoms of anxiety were

detected – $11,7 \pm 0,8$ points, $\chi^2 = 5,6$ ($p > 0,05$) (Table 1). Consequently, the difference was detected in the particles of people with an increased level of anxiety, depending on the level of neuropathy of IAN.

On the 3rd postoperative day, the tissue swelling in the area of surgical intervention decreased on the background of medical treatment, but the symptoms of neuropathy of the IAN were maintained. The number of patients with elevated anxiety level increased to 8 (26,7 %) in patients with a mild degree of neuropathy of the IAN and in all patients with a moderate degree of neuropathy of this nerve, $\chi^2 = 12,34$ ($p < 0,01$). This was due to the preservation of patients' sensitivity disorders of the IAN at the present time and the appearance of neuropathic pain, which caused anxiety and psycho-emotional discomfort. Nerve pain manifest as continuous or episodic, with episodic attacks described as an electric shock and continuous attacks often experienced as feelings of prolonged aching, burning, sensitivity or coldness.

Statistical analysis has established that the level of neuropathy of the IAN affects the appearance of anxiety in patients after the removal of ILTM.

Depending on the results of determining the level of cortisol in the oral fluid, patients were divided into 2 groups: the first group of patients with cortisol above the physiological norm ($> 6,65 \text{ ng / ml}$) and the 2nd group - within the physiological norms ($< 6,65 \text{ ng / ml}$).

Table 1 Division of patients according to the level of anxiety and the level of neuropathy of the IAN after the removal of ILTM, the number of patients (%)

Neuropathy level IAN	Anxiety level on the 1-st day after operation removal of ILTM		Anxiety level on the 3-d day after operation removal of ILTM	
	Absence of anxiety	Increased level of anxiety	Absence of anxiety	Increased level of anxiety
No neuropathy symptoms	3(10,0)	0	3 (10,0)	0
Mild neuropathy level	11(36,7)	6(20,0)	9(30,0)	8(26,7)
Moderate neuropathy level	3(10,0)	7(23,3)	0	10(33,3)
Pearson x-square criterion (χ^2)	$\chi^2 = 5,6$ ($p > 0,05$)		$\chi^2 = 12,34$ ($p < 0,01$)	

The study of the particles of patients with different cortisol contents, depending on the level of anxiety, is presented in table 2.

Table 2 Division of patients by level of anxiety and cortisol content, number of patients (%)

Anxiety level/ Cortisol level	The 1-st day after operation removal of ILTM		The 3-rd day after operation removal of ILTM	
	above the physiological norm (> 6, 65 ng / ml)	within the physiological norms (< 6, 65 ng / ml)	above the physiological norm (> 6, 65 ng / ml)	within the physiological norms (< 6, 65 ng / ml)
Absence of anxiety	0	17(56,7)	0	12(40,0)
Subclinical symptoms of anxiety	5(16,7)	1(3,3)	7(23,3)	1(3,3)
Clinical symptoms of anxiety	7(23,3)	0	10(33,3)	0
Pearson x-square criterion (χ^2)	$\chi^2 = 26,53$ ($p < 0,001$)		$\chi^2 = 26,44$ ($p < 0,001$)	

In the absence of anxiety, none of the patients showed an increase of cortisol levels in the oral liquid above the physiological norm.

On the 1st day of the postoperative period, cortisol increased in 5 (16,7%) patients with subclinical manifestations of anxiety and in 7 patients (23,3%) -with clinical manifestations ($\chi^2 = 26,53$, $p < 0,001$). On the 3rd day, cortisol was elevated in 7 people (23,3%) with subclinical manifestations of anxiety and in 10 patients (33,3%) with clinical manifestations ($\chi^2 = 26,44$, $p < 0,001$).

Discussion. The present study showed a correlation between increases in mean scores of anxiety scale and increased postoperative pain levels in patients undergoing wisdom teeth extraction. These results are in agreement with those of other authors who reported significant correlations between dental anxiety and fear and postoperative pain (19, 20). The persons with high levels of dental anxiety tend to perceive high levels of pain, which can influence physiological recovery after surgery (21). Similarly, other studies have found that persons with high levels of state anxiety and dental anxiety tended to anticipate high levels of surgical pain and postoperative pain (22, 23). Patients with high trait anxiety showed more pain according to all of the postoperative

measures and to a significant degree in the last 2 postoperative days evaluated (24). Trigeminal nerve injuries are a known complication of third molar surgery (25). Traumatic injury to the trigeminal nerve is associated with a substantial patient burden, particularly in patients who experience neuropathic pain as part of their condition (26). Neuropathic pain is associated with comorbid anxiety and depression. Patients with more severe pain demonstrate elevated levels of depression and pain catastrophizing, as well as substantially reduced quality of life (QoL) and coping efficacy levels. These findings highlight the need to identify, develop, and evaluate more effective treatments for neuropathic pain in trigeminal nerve injury that will not only provide clinically meaningful reductions in pain but also improve patients' quality of life (27, 28).

Conclusions. The appearance of clinical symptoms of the inferior alveolar nerve neuropathy and postoperative pain in patients after the removal of retained lower third molars leads to the manifestation of psychoemotional stress (anxiety) of varying degrees of severity, which has a direct correlation. At the same time, an increase in the level of anxiety causes an increase in the level of cortisol in the oral fluid in patients, which is statistically confirmed.

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