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Investigation of the algesic perception types observed in dental patients with different individual psychological characters

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Objective. To study the reaction of an organism on pain.

Materials and methods. Clinical investigations have been carried out on 95 patients with maxillofacial diseases that were prepared for elective surgery. The type of temperament was determined by means of the H. Aizenko psychological testing. The level of activity of nociceptive and antinociceptive systems was studied by means of methodology of exteroceptive suppression of arbitrary muscular activity. The pain stress was simulated by the mental nerve electro-stimulation with the measurements of the levels of algesthesia and tolerance to the pain stressor. A high sensitiveness to pain and insufficient functional activity of the antinociceptive system have been diagnosed in the majority of patients with the melancholy type of temperament (89 % cases).

Results and discussion. All temperamental persons had subzero sensory thresholds. However, in 65 % of cases, the electro sensormetry reveled the functional manifestations of the stress inductive analgesy, i.e. the increase of brake action of the endogenous checking of pain system in reply to the increase of intensity of nociceptive stimulus. Considerable tolerance to pain was observed in the majority of sanguinic (59 %) and phlegmatic (73%) persons.

Conclusions. The close cross-correlation has been defined between the type of pain perception and individually-psychological features (by temperament). It was more expressed in melancholic persons and phlegmatic persons. The pain tolerance (emotional constituent of nociperception) depended on the level of activating of endogenous mechanisms of antinociception.

Key words: algesthesia, antinociceptive system, sensometria, electromyography, psychoemotional condition, temperamental suitability, surgical interference, maxillofacial area.

One of the causes rousing stress in dental patients is their fear of surgical attack and pain expectation [1, 4, 5]. Thus, neurosis leads to tissue hyperalgesia resulted by the transformation of tactic senses to algesic perception and from slight pain to acute pain sense modality. Pain sense is influenced by fear [6, 10]. Algesthesia is measured in pain limit levels and is defined as the integrated body response indicator reflecting the dynamic balance of the anatomically and neurochemically interrelated nociceptive and antinociceptive systems [9]. Automous nervous system (ANS) is the polycomponent endogenic system of algesthesia control and regulation. It is developed on the different levels of the cerebrospinal system; is represented by segmental and suprasegmental control levels and by humoral mechanisms — opioid, monoaminergic (noradrenaline, dopamine, serotonin), GABA-ergic systems. ANS is responsible for the peculiarities of individual klendusity to outer algogenic factors. The key role of ANS in emotion regulation and the modulation of stress reaction somatic symptoms raises no doubts [8].

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Sensometria is paid special attention as the objective diagnostic technique of psychoemotional stress level. Sensometria as the subjective-objective method is applied provided that the patient is involved in the process of conscious perception analysis. It gives a possibility to define an emotionally tensioned patient's response to the inductive stimulus of different intensity, including pain [1, 4, 6, 9]. The registration method of nociceptive flexor reflex (NFL) being a typical defensive reflex to pain — elecrtostimulation n. suralis or plantaris foot is widely applied for the investigation of defensive manifestations (motor reaction) expressed as a reaction to noxious stimulus [3, 9]. The method of exteroceptive supression of muscle voluntary activity m. masseter or m. temporalis is a variety of nociceptive flexor reflex. It is the repression of a mouth opening reflex (masseter and temporal contraction) as a reaction to a pain stimulus (peri- or intraoral) [3]. Under normal conditions the mentioned above reflex is a physiological response caused by the activation of cerebrum stem interneurons blockading the functions of motoneurons responsible for the neuromotor innervation of masseter muscles and mandibular lifting. Inserted neurons, in their turn, are under constant functional control of subcortical structures: limbic systems, periaqueductal grey and mag-

Table 1

Sensometria indixes revealed by patients with different types of pain perception

Types of pain perception (n — 95 patients)	Pain limit		Pain tolerance	
	Value of electric stimulus (mA)	Period duration ES 2 (ms)	Value of electric stimulus (mA)	Period duration ES 2 (ms)
I (n — 26 patients)	9,62 ± 2,07	57,2 ± 3,7	25,41 ± 1,47	74,35 ± 1,85 ($p < 0,05$)*
II (n — 35 patients)	10,73 ± 0,53	81,12 ± 4,30	35,61 ± 0,95	59,46 ± 3,27 ($p < 0,01$)
III (n — 20 patients)	25,48 ± 0,87	42,84 ± 1,59	30,95 ± 1,12	56,92 ± 2,30 ($p < 0,05$)
IV (n — 14 patients)	25,91 ± 2,49	43,4 ± 4,12	39,84 ± 1,21	41,5 ± 4,03 ($p > 0,05$)

* Note. The comparison of ES 2 values received during the investigation of pain limits displayed by patients of the same examined groups.

num mesen which play a crucial role in the endogenic regulation (extinction) of pain. This neurofunctional diagnostic technique is widely applied in neurology for conducting the integrated survey of patients suffering from cephalalgia and facial pain [2]. Nevertheless, none available literary source contains the information about the method of sensometria applicable for investigating the pain sensitivity manifested by patients of different typological features of mentality.

The aim. Investigation of pain perception and functional activity of anticiceptive system expressed by dental patients with different individual and psychological qualities while applying the method of exteroceptive suppression of muscle voluntary activity.

Materials and methods

95 dental patients of the oral surgery department of the Lviv regional clinical hospital (37 women and 58 men of 15—65 years old) have been targets of clinical study. All the patients have undergone psychological testing. H. Eysenck's questionnaire was applied to define their temperamental suitability, as well as their introversion and extraversion levels. The neurosensometric research was carried out with the implementation of the bi-channel electromyography M-TEST (Ukraine). The diagnostic technique of exteroceptive suppression of muscle voluntary activity was applied to define pain limits: pain sensitivity (irritation of the least irritation perceived as pain), pain tolerance (the highest pain intensity a person can endure which displays the emotional and volitional qualities), and the algesthesia range (interval between the pain limit and pain tolerance) [1, 7]. Skin electrodes were applied to register the biopotential of masseter muscles. The active electrode (cathode) was placed on the anterior part of the masticatory muscle (m. Masseter) and the referential one was attached before the antilobium. The stimulating electrode was located at the trigeminal nerve exit point (mental nerve) and the ground electrode was placed on the upper arms. Stimuli lasting 1 ms were being supplied each 10 ms with the starting value of 5 mA. Reflexes to the mental nerve stimulation incoming from both masticatory muscles were registered simultaneously from each side. Electrical stimulation of mental nerve in the lower lip area was conducted with tightly clenched teeth and lasted till the moment of pain sensitivity (pain limit). The mentioned above actions gave rise to the periods of early (ES 1) and advanced (ES 2) exteroceptive suppression of the defined muscles. The latent periods of ES 1 and ES 2 were analyzed. The duration of the second (advanced) period of exteroceptive suppression ES 2 revealed the activity of cerebrum antinociceptive mechanisms. The longer duration of the ES 2 under the conditions of increasing pain stimuli values is interpreted as the function failure of endogenic analgetic system. The classification of A. Sanhailo was applied to divide

Table 2

Types of pain perception revealed by dental patients with different individual and psychological qualities

Types of pain perception	Demonstration of temperament			
	Melancholic type (n — 18)	Phlehmatic type (n — 11)	Sanguinic type (n — 37)	Choleric type (n — 29)
I	16 patients	Not revealed	Not revealed	10 patients
II	Not revealed	Not revealed	16 patients	19 patients
III	2 patients	3 patients	15 patients	Not revealed
IV	Not revealed	8 patients	6 patients	Not revealed

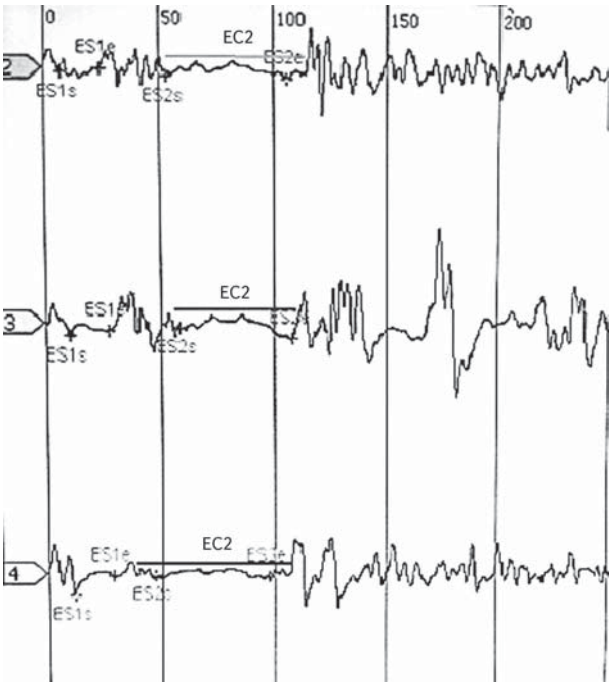

Figure 1. **The patient's electromyogram belonging to the I type of pain perception. The enhancing of pain agitation did not lead to the alertness of antinociceptive system — the second period of m. Masseter activity suppression (ES 2) increased**

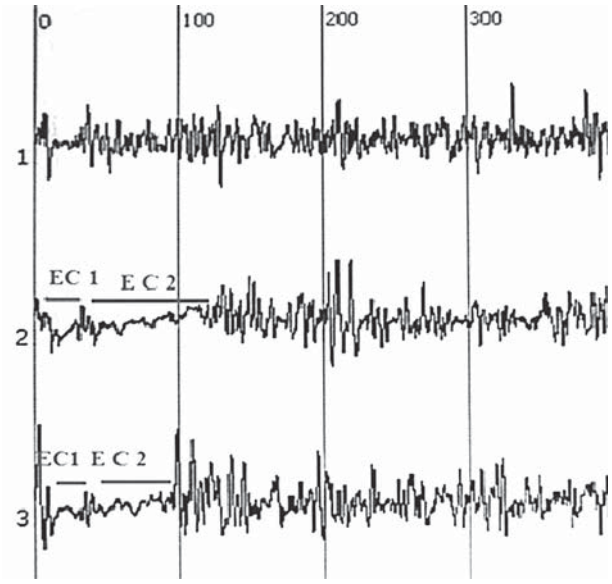

Figure 2. **The patient's electromyogram belonging to the II type of pain perception. The enhancing of pain agitation caused the alertness of antinociceptive system — the second period of m. Masseter activity suppression (ES 2) shortened**

the patients into the types of their pain perception. Patients referring to the first (weak) type have a small range of pain sensitivity, and a low pain limit quickly followed by pain tolerance. The patients of the second type have a low pain limit, but their pain tolerance is high leading to a big algesthesia range. The third type includes people with a high pain limit, though pain is hardly endured and the algesthesia range is small. Those referring to the fourth type have high pain threshold and pain tolerance, as well as a considerable algesthesia range. The statistic data were processed by means of a statistic software application «Statistica 7».

Results and discussion

The results of psychological testing as per Eysenk' methodology, discovered the following: 18 patients (18.9 %) showed the psychological signs of a melancholic type and 11 (11.6 %) revealed the symptoms of a phlegmatic type. A significant amount of respondents — 69.5 % (66 people) turned out to be extraverts: 29 (30.5 %) patients belonged to a choleric type while 37 examined people demonstrated to have a sanguinic type.

Sensometric research has given an opportunity to observe the impact of algetic factors made on the nervous system of the examined patients (Table 1). 26 people revealed the I type of pain perception. Their pain threshold was diagnosed at the electric stimulus value of 9.62 ± 2.07 mA, pain tolerance was equal only to 25.41 ± 1.47 mA. The increasing of electrical stimulus within the limits of pain sensitivity caused the progressive prolongation of exteroceptive suppression of masseter muscles activity (ES 2) from 57.2 ± 3.7 ms till 74.35 ± 1.85 ms ($p < 0.05$) which testified the deficient functional capacity of the antinociceptive system (Figure 1).

The compare of group testing results discovered the fact that the overwhelming majority of examined patients (16 people) belonged to the melancholic type while the rest 10 were choleric. The pain limits of patients belonging to the II pain perception type approximated those of the I type, though their algesthesia range turned out to be much bigger from 10.73 ± 0.53 mA till 35.61 ± 0.95 mA. Those patients displayed the functional symptoms of stress induced analgesia (Figure 2): statistically ($p < 0.01$) the second period of m. Masseter activation suppression (ES 2) was being shortened — from 81.12 ± 4.30 mA till 59.46 ± 3.27 mA. That type of pain perception was shared by 35 patients, 19 of which were choleric and the rest 16 belonged to the sanguinic type.

The patients of the III and IV types of pain perception were diagnosed with high pain limits (25.48 ± 0.87 mA — 25.91 ± 2.49), though the insufficient activation of the endogenic analgetic system in the III group resulted in short algesthesia range.

The patients were unable to endure the increasing electric stimulus for a long period of time. Such a type of pain perception was revealed by 15 people of a sanguinic type, 3 patients of a phlegmatic type and 2 representatives of a melancholic type. The IV pain perception type patients showed high outlet rates of the antinociceptive system alertness. A short duration of the second suppression period (ES 2) of m. Masseter activation was stable and varied from 43.4 ± 4.12 ms till 41.5 ± 4.03 ms ($p > 0.05$) during the diagnosing. Most group members (8 people) belonged to the phlehmatic type and 6 patients were of sanguinic type (Table 2).

Conclusions

1. The interrelation between the individual psychological qualities and pain perception types has been discovered and is the most evident for melancholic and phlehmatic types.

2. The patients belonging to the first nociceptive type have the insufficient activity of the endogenic pain control system. The patients of the IV nociceptive type reveal the highest outlet level of antinociceptive mechanisms operation alertness. While reacting to pain electrical stimuli the patients referring to other pain perception types reveal different activation levels and tempos of antinociceptive system mobilization. From our perspective, algesthesia range values define the emotional (volitional) component of a person's response to algogenic factors.

3. Application of the exteroceptive suppression method of the muscle voluntary activity gives an objective estimation of algesthia and the functional activity of the anticiceptive system displayed by dental patients with different individual and psychological qualities.

References

1. Гришанин Г.Г. Стресс в стоматологии. — Харьков: Каравелла, 1998. — 172 с.
2. Данилов А.Б. Методы исследования механизмов боли. Болевые синдромы в неврологической практике. — М.: МЕДпресс-информ, 2010. — С. 44—71.
3. Джелдубаева Э.Р., Чуян Е.Н., Богданова О.В. та ін. Электронейромиографические исследования болевой чувствительности // Нейрофизиология. — 2009. — Т. 41, № 3. — С. 251—271.
4. Ишинова В.А. Роль негативных эмоций при восприятии боли у пациентов с тревожно-фобическими и соматоформными расстройствами: автореф. дис. ...канд. психол. наук: спец. 19.00.04 «Мед. психология». — Санкт-Петербург, 2009. — 19 с.
5. Михальченко В.Ф. Системные механизмы формирования эмоционального напряжения человека в условиях стоматологического приема: автореф. дис. ... д-ра мед. наук: спец. 03.00.13 «Физиология», 14.00.21 «Стоматология». — Волгоград, 2002. — 30 с.
6. Московец О.Н., Демина Н.А., Рабинович С.А. Влияние эмоционального состояния на болевую чувствительность зубов у пациентов на амбулаторном стоматологическом приеме // Боль. — 2003. — № 1. — С. 44—46.
7. Сангайло А.К. О взаимоотношениях ощущения боли и эмоций страха у человека и путях регулирования их // Боль и борьба с ней. — Свердловск, 1966. — С. 84—86.
8. Яхно Н.Н., Захаров В.В., Локшина А.Б. и др. Боль: руководство для студентов и врачей. — М.: МЕДпресс, 2009. — 304 с.
9. Mathieu Roy, Mathieu Piché, Jen-I. Chenf [and others] Cerebral and spinal modulation of pain by emotions // PNAS. — 2009. — Vol. 106 (49), N 9. — P. 20900—20905.
10. Villemure C., Slotnick B.H., Bushnell M.C. Effects of odors on pain perception: deciphering the roles of emotion and attention // Pain. — 2003. — Vol. 106, N 2. — P. 101—108.

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Вивчення типів больової перцепції у стоматологічних хворих із різними індивідуально-психологічними особливостями

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Мета роботи — вивчити реакцію організму людини на біль.

Матеріали та методи. Об'єктом клінічного спостереження стали 95 хірургічних стоматологічних хворих, яких готували до планових оперативних втручань. За допомогою психологічних тестувань за методикою Г. Айзенка визначали типи темпераменту. Виявляли рівень активності ноцицептивної й антиноцицептивної систем за допомогою методики екстероцептивної супресії довільної м'язової активності. Больовий стрес моделювали шляхом електростимуляції підборідного нерва. При цьому вимірювали рівень больової чутливості та толерантності до дії больового стресора. У більшості пацієнтів із меланхолічним типом темпераменту (89 %) діагностовано високу чутливість до болю та недостатню функціональну активність антиноцицептивної системи.

Результати та обговорення. Всі холерики мали низькі сенсорні пороги. Однак у 65% випадків під час електросенсометрії виявлено функціональні вияви стресіндукованої анальгезії — зростання гальмівної дії ендогенної сис-

теми контролю болю у відповідь на збільшення інтенсивності ноцицептивного стимулу. Значна толерантність до болю спостерігалася у більшості флегматиків (73 %) та сангвініків (59 %).

Висновки. Встановлено тісний кореляційний зв'язок між типом больової перцепції та індивідуально-психологічними особливостями (темпераментом) пацієнтів. Найвиразніше це простежується у меланхоліків та флегматиків. Больова толерантність (емоційна складова сприйняття болю) хворих залежить від рівня активізації їхніх ендогенних механізмів антиноцицепції.

Ключові слова: больова чутливість, антиноцицептивна система, сенсометрія, електроміографія, психоемоційний стан, темперамент, хірургічне втручання, щелепно-лицева ділянка.

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Изучение типов болевой перцепции у стоматологических больных с различными индивидуально-психологическими особенностями

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Цель работы — определить реакцию организма человека на боль.

Материалы и методы. Объектом клинического наблюдения стали 95 хирургических стоматологических больных, которых готовили к плановым оперативным вмешательствам. С помощью психологических тестирований за методикой Г. Айзенко определяли тип темперамента. Уровень активности ноцицептивной и антиноцицептивной систем изучали с помощью методики экстероцептивной супрессии произвольной мышечной активности. Болевой стресс моделировали путем электростимуляции подбородочного нерва. При этом измеряли уровень болевой чувствительности и толерантности к действию болевого стрессора. У большинства пациентов с меланхолическим типом темперамента (89 % случаев) диагностирована высокая чувствительность к боли и недостаточная функциональная активность антиноцицептивной системы.

Результаты и обсуждение. У всех холериков были низкие сенсорные пороги. Однако в 65% случаев во время электросенсометрии обнаружены функциональные проявления стресс-индуктируемой анальгезии — роста тормозного действия эндогенной системы контроля боли в ответ на увеличение интенсивности ноцицептивного стимула. Значительная толерантность к боли наблюдалась у большинства флегматиков (73 %) и сангвиников (59 %).

Выводы. Установлена тесная корреляционная связь между типом болевой перцепции и индивидуально-психологическими особенностями (темпераментом) пациентов. Более выраженно это прослеживается у меланхоликов и флегматиков. Болевая толерантность (эмоциональная составляющая восприятия боли) зависит от уровня активации эндогенных механизмов антиноцицепции.

Ключевые слова: болевая чувствительность, антиноцицептивная система, сенсометрия, электромиография, психоэмоциональное состояние, темперамент, хирургическое вмешательство, челюстно-лицевая область.