

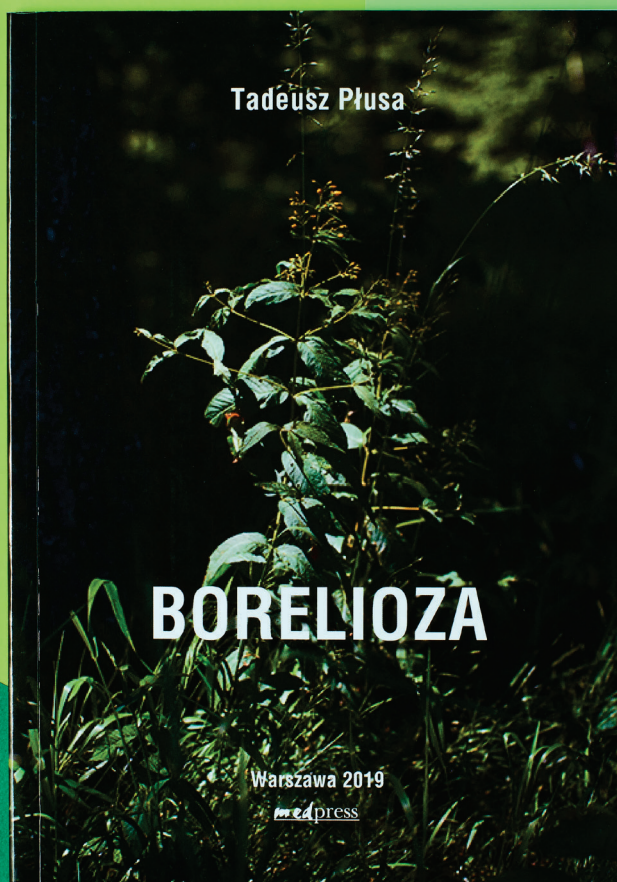
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Results of videokinesiography in patients with a complicated course of acute cerebrovascular disorder by hemitype in the recovery period

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A – research concept and design, B – data collection, C – data analysis and interpretation, D – article writing, E – critical review of the article, F – final approval of the article

Results of videokinesiography in patients with a complicated course of acute cerebrovascular disorder by hemitype in the recovery period

Toncheva K, Korol D, Zubchenko S, Yarkoviy V, Kindiy D.

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Restoration of the masticatory function is one of the key elements in the comprehensive rehabilitation for patients with acute cerebrovascular disorders (ACVD) of various degrees, as their consequences may include an impaired coordinated action of the neuromuscular system, and the dentoalveolar system in particular. In this context, the clinical presentation of stroke is characterized by motor and sensory deficiencies, which can eventually lead to dysfunction of the masticatory muscles, tongue, lips, soft palate and pharynx. The bilateral difference between such disorders, manifested by the discrepancy in the muscle mass and kinematic characteristics, is the peculiarity of this phenomenon.

The aim of the research was to examine the features of articulatory activity in the mandible during chewing at the stages of orthopedic rehabilitation in patients with complicated acute cerebrovascular disorder with the neurological deficit by hemitype during the prosthetics with removable orthopedic appliances.

Materials and methods. The study sample consisted of 45 subjects aged from 40 to 65 years, including 24 women (53%) and 21 men (47%). The study group included 25 patients with complicated ACVD with the neurological deficit by hemitype and 20 subjects for control who did not have general somatic disorders. All patients underwent prosthetics with partial removable laminar dentures with acrylic base and clasp fixation system.

Conclusions. Non-parametric comparison in the groups showed that the most significant differences in videokinesiography between the representatives of the second group (ACVD) and the control group on the 30th day of observation were: a relatively smaller amplitude of vertical movements ($p = .0001$) and smaller amplitude of horizontal movements ($p = .0000$). Thus, the amplitude of vertical and horizontal movements of the mandible, in our opinion, can be considered as a reliable marker of the functional activity of the dentoalveolar system in patients with a complicated course of ACVD by hemitype, which should be considered in further studies.

Key words: kinesiology, functional diagnostics, removable prosthetics, stroke, rehabilitation

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Wyniki wideokinezyjografii u chorych z powikłanym przebiegiem ostrych zaburzeń naczyniowo-mózgowych w przebiegu niedowładu połowicznego w okresie rekonwalescencji

Toncheva K, Korol D, Zubchenko S, Yarkoviy V, Kindiy D.

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Przywrócenie funkcji żucia jest jednym z kluczowych elementów kompleksowej rehabilitacji chorych z ostrymi zaburzeniami naczyniowo-mózgowymi (ACVD) różnego stopnia, gdyż ich następstwem może być upośledzenie skoordynowanego działania układu nerwowo-mięśniowego, a zwłaszcza żębowo-zębodołowego. W tym kontekście kliniczne objawy udaru charakteryzują się niedoborami motorycznymi i sensorycznymi, które mogą ostatecznie prowadzić do dysfunkcji mięśni żucia, języka, warg, podniebienia miękkiego i gardła. Specyfiką tego zjawiska jest obustronna różnica między takimi zaburzeniami, przejawiająca się rozbieżnością w masie mięśniowej i charakterystyce kinematycznej.

Celem badań było określenie cech czynności artykulacyjnej żuchwy podczas żucia na etapach rehabilitacji ortopedycznej u chorych z powikłanymi ostrymi zaburzeniami naczyniowo-mózgowymi z deficytem neurologicznym wywołanym spowodowanym przez niedowład połowiczny podczas wykonywania protez z ruchomymi aparatami ortopedycznymi.

Materiały i metody. Badana próba liczyła 45 osób w wieku od 40 do 65 lat, w tym 24 kobiety (53%) i 21 mężczyzn (47%). Grupa badana obejmowała 25 chorych z powikłanymi ACVD z deficytem neurologicznym wywołanym przez niedowład połowiczny oraz 20 pacjentów kontrolnych, którzy nie mieli ogólnych zaburzeń somatycznych. U wszystkich badanych wykonano protezę z częściowo zdejmowanymi protezami laminarnymi z podstawą akrylową i systemem mocowania klamrami.

Wnioski. Porównanie nieparametryczne w grupach wykazało, że najbardziej istotnymi różnicami w wideokinezyjografii między przedstawicielami grupy drugiej (ACVD) a grupą kontrolną w 30 dniu obserwacji były: relatywnie mniejsza amplituda ruchów pionowych ($p = .0001$) oraz mniejsza amplituda ruchów poziomych ($p = .0000$). Zatem amplituda pionowych i poziomych ruchów żuchwy, naszym zdaniem, może być uznana za miarodajny marker czynności funkcjonalnej układu żębowo-pęcherzykowego u chorych z powikłanym przebiegiem ACVD przez niedowład połowiczny, co należy wziąć pod uwagę w dalszych badaniach.

Słowa kluczowe: kinezyjografia, diagnostyka czynnościowa, protetyka ruchoma, udar mózgu, rehabilitacja

Pol Merkur Lekarski, 2022; L (297); 187–189

It is well known that the partial or complete absence of teeth leads to a decrease in vital functions (chewing, speech). However, no less important is its pathological impact on the patient's socio-psychological sphere. Thus, this relationship underlies the determination of anodontia with the social sphere of human life. The research literature has repeatedly drawn attention to the relationship between quality of life and the course of pathological processes, as well as the aspects

related to physical and psychological health and social functioning [9].

Restoration of the masticatory function is one of the key elements in the comprehensive rehabilitation for patients with acute cerebrovascular disorders (ACVD) of various degrees, as their consequences may include an impaired coordinated action of the neuromuscular system, and the dentoalveolar system in particular [7,8].

In this context, the clinical presentation of stroke is characterized by motor and sensory deficiencies, which can eventually lead to dysfunction of the masticatory muscles, tongue, lips, soft palate and pharynx. The bilateral difference between such disorders, manifested by the discrepancy in the muscle mass and kinematic characteristics, is the peculiarity of this phenomenon. This is due to the direct central action on afferent sensors, which leads to an impaired motor function and changes in the typical activity [1,2,3,6].

Given the above, prosthetics of patients with a complicated course of ACVD by hemitype in the recovery period has its own characteristics. Since the general somatic diagnosis is dominant for these patients, the main direction of orthopedic rehabilitation will be not only the restoration of the masticatory function, but also the formation of a normal stereotype of articulation. The rate and completeness of this recovery will depend on the quality of the manufactured prosthetic appliances, as well as on a set of physiotherapeutic methods of exposure.

Unfortunately, in the studies related to this topic, the problem of comprehensive rehabilitation for patients with ACVD using partial removable laminar dentures has not yet been fully disclosed, and therefore this issue requires an in-depth study.

That is why the aim of this study was to examine the features of articulatory activity in the mandible during chewing at the stages of orthopedic rehabilitation in patients with complicated acute cerebrovascular disorder with the neurological deficit by hemitype during the prosthetics with removable orthopedic appliances.

MATERIAL AND METHODS

The sample consisted of 45 subjects aged from 40 to 65 years, including 24 women (53%) and 21 men (47%). The study group included 25 patients with complicated ACVD with the neurological deficit by hemitype and 20 subjects for control who did not have general somatic disorders. All patients underwent prosthetics with partial removable laminar dentures with acrylic base and clasp fixation system. The selection criteria for the experimental group were as follows: preliminary examination and treatment at the neurosurgical and neurological departments of the Municipal Enterprise "Poltava M.V. Sklifosovskiy Regional Clinical Hospital of Poltava Regional Council", and at the neurological department of the Municipal Enterprise "The 1st City Clinical Hospital of Poltava City Council", as well as presentation for prosthetics to the orthopedic department of the Educational and Research Medical Dental Center of Ukrainian Medical Stomatological Academy.

All patients gave voluntary written consent to participate in the study.

The procedure for studying the movements of the mandible involved video recording of the process of chewing the test samples using a web-camera. To do this, a special contrast marker was fixed on the patient's chin. Further analysis consisted of software calculation of the spatial position of the marker in each frame of the obtained video (video tracking). Numerical data on the rate and amplitude of articulatory movements of the mandible were obtained in the Tracker software. The web-camera was placed at the level of the chin, with due attention to the constant and equal distance between the camera lens and the marker. This location of the web-camera allowed us to register the movements of the mandible, without taking into account possible minor movements of the head. The video was captured using the AVS Videorecorder (Online Media Technologies Ltd.). The study of the trajectories of the mandible was performed by digital analysis of videos obtained during the performance of tasks. The obtained curve in the coordinate system along the Y axis (vertical movements of the mandible up and down) and the X axis (video recording time) characterized the displacement of the mandible down and up, i.e., its depression and return to occlusal contact. The software also allowed us to obtain a numerical characteristic of the vertical and horizontal rate of articulatory movements of the mandible (V_y , V_x), which varied depending on the phase of the masticatory act (fig. 1) [4,5].

The statistical analysis of the results was performed using the Statistica 10.0 software package for Windows, and it embraced the following processes:

1. Estimating the distribution of values and its correspondence to the normal one in the population.
 2. Comparison of the results obtained in the period before placing a removable prosthetic appliance and 30 days after its placement.
 3. Intergroup comparison of the results (tab. 1).
- The level of statistical significance in the study was 0.05%.

RESULTS AND DISCUSSION

The study consisted of two successive stages. The first stage aimed to determine the average velocity of vertical and horizontal movements of the mandible. It turned out that in the control group before orthopedic treatment it equaled 0.224 (std. err. 0.041) in the vertical direction of movement and 0.130 (std. err. 0.246) in the horizontal direction. The changes that occurred 30 days after in the above group were represented by an incre-

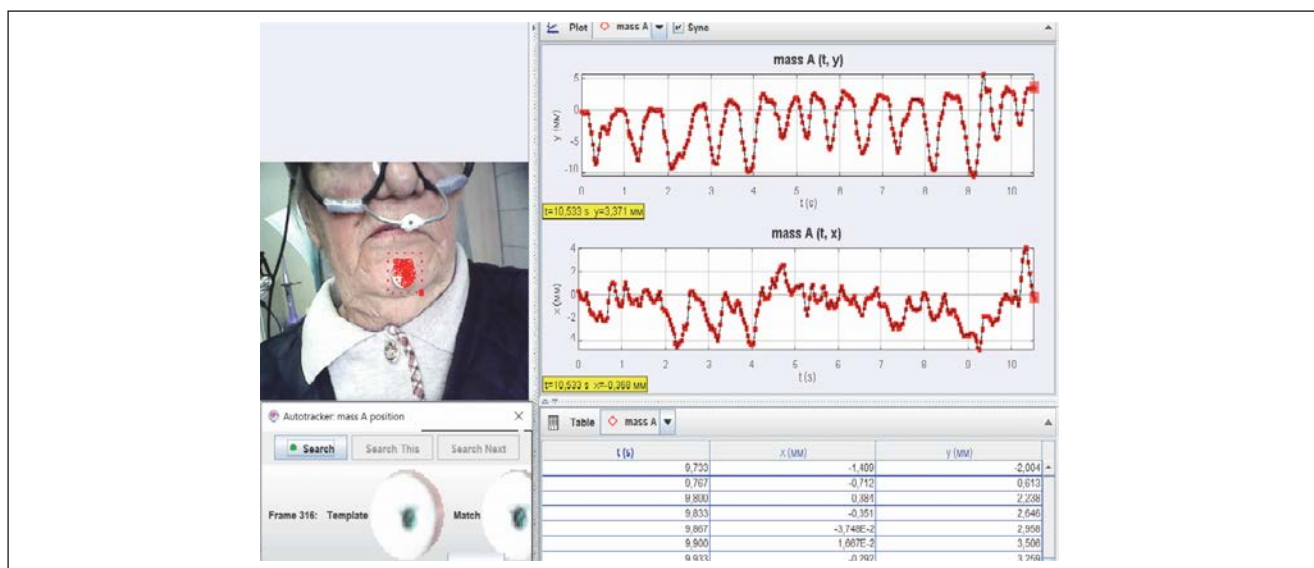


Figure 1. The work view of the software in the process of recording videokinesigrams
Rycina 1. Widok roboczy programu w trakcie rejestracji wideokinezyogramów

ase in the vertical velocity up to 0.488 (std. err. 0.055) and the horizontal velocity – up to 0.174 (std. err. 0.298).

At the same time, in the second group (patients with ACVD), the vertical velocity of the mandible before prosthetics was 0.122 mm/s (std. err. 0.017), and the horizontal velocity was 0.126 mm/s (std. err. 0.022). On the 30th day of observation, the vertical velocity values increased up to 0.443 mm/s (std. err. 0.029) and the horizontal velocity – up to 0.162 mm/s (std. err. 0.017).

The second stage was to determine the changes in the numerical indicators of the amplitude of vertical and horizontal movements of the mandible. We found that before orthopedic treatment, the vertical amplitude, corresponding to the maximum lowering of the jaw and its return to the occlusal contact with the opposing teeth, was in the range from 11.98 mm to 16.99 mm (mean = 14.22 mm, std. err. 0.391).

The horizontal amplitude of movements, corresponding to the maximum lateral displacement of the mandible to the left and right, averaged 9.268 mm (std. err. 0.552) with minimum and maximum values of 5.690 mm and 11.69 mm, respectively. On the 30th day after denture placement in the control group, the amplitude of vertical movements increased by an average of 0.53 mm. The changes in the horizontal amplitude were more implicit since this amplitude increased by an average of 1.82 mm.

In the second study group, the amplitude averaged 10.73 mm (std. err. 0.155) for vertical movements of the mandible, and 7.944 mm (std. err. 0.384) for the horizontal movements, before placement of a prosthetic appliance. 30 days later, there was a similar increase in the numerical indicators of the amplitude, up to 12.38 mm (std. err. 0.151) in the vertical direction, and up to 9.845 mm (std. err. 0.199) in the horizontal direction.

CONCLUSIONS

Further non-parametric comparison in the groups showed that the most significant differences in videokinesiology between the representatives of the second group (ACVD) and the control group on the 30th day of observation were: a relatively smaller amplitude of vertical movements ($p = .0001$) and smaller amplitude of horizontal movements ($p = .0000$). The absence of a statistically significant difference between the average values of vertical and horizontal rates within the groups ($p = .5601$ and $p = 1.000$) is noteworthy.

Thus, the amplitude of vertical and horizontal movements of the mandible, in our opinion, can be considered as a reliable

marker of the functional activity of the dentoalveolar system in patients with a complicated course of acute cerebrovascular disorders by hemitype, which should be considered in further studies.

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Table 1. Corresponding values of the amplitudes in vertical and horizontal movements of the mandible in the study groups

Tabela 1. Odpowiadajace wartosci amplitud w ruchach pionowych i poziomych zuchwy w badanych grupach

The amplitude of vertical movements before placement of a prosthetic appliance (mm)			
<i>Kruskal-Wallis test: H (1, N= 45) =31.07250 p =.0000</i>			
Group number	Number of subjects (n)	Total amount (mm)	Average value (mm)
1	20	704.0000	35.20000
2	25	331.0000	13.24000
The amplitude of vertical movements 30 days after placement of a prosthetic appliance (mm)			
<i>Kruskal-Wallis test: H (1, N= 45) =14.90237 p =.0001</i>			
Group number	Number of subjects (n)	Total amount (mm)	Average value (mm)
1	20	629.0000	31.45000
2	25	406.0000	16.24000
The amplitude of horizontal movements before placement of a prosthetic appliance (mm)			
<i>Kruskal-Wallis test: H (1, N= 45) =5.535130 p =.0186</i>			
Group number	Number of subjects (n)	Total amount (mm)	Average value (mm)
1	20	563.0000	28.15000
2	25	472.0000	18.88000
The amplitude of horizontal movements 30 days after placement of a prosthetic appliance (mm)			
<i>Kruskal-Wallis test: H (1, N= 45) =17.95672 p =.0000</i>			
Group number	Number of subjects (n)	Total amount (mm)	Average value (mm)
1	20	645.0000	32.27500
2	25	389.0000	15.58000