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Treatment of Postoperative Neuropathy of the Trigeminal Nerve

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ABOUT ARTICLE

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ABSTRACT

Purpose.
Study the possibility of using hardware-software complex "DIN-1" in the complex treatment of neuropathies of II and III branches of the trigeminal nerve of varying severity (contusion, stretching, partial, and complete rupture of the nerve) after tumor and tumor-like formations of jaws removal.
Patients and Methods.
Treatment of neurological complications of 146 patients after surgical interventions associated with the removal of tumors and tumor-like formations of the upper and lower jaws using a hardware-software complex "DIN-1".
Results.
Based on the examination, found that the use of hardware-software complex "DIN-1" has a high therapeutic efficacy in the complex treatment of trigeminal nerve neuropathy after removal of tumors and tumor-like formations of jaws.
Conclusions.
Our findings can be used in treatment of neuropathies of II and III branches of the trigeminal nerve of varying severity (contusion, stretching, partial, and complete rupture of the nerve) after removal of tumors and tumor-like formations of jaws.

Introduction

In our last published article we have undertaken an analysis of postoperative complications, that show up after removal of tumors and tumor-like formations of jaws [1]. There are a lot publications dedicating to the trigeminal nerve injuries upon third molar removal [7, 8], dental implants placement [9-13], orthognathic surgeries [14-19], distraction procedures [20, 21], zygomaticomaxillary complex fractures [22, 23], but only a little amount of papers dedicating to the problem of post-operative disturbances after tumors removal [24]. We have found out that by defining electrophysical index of soft tissues, which are innervated by II and II branches of trigeminal nerve, after operations of neoplasm removal you can define the severity of injury of trigeminal nerve during operation. It's a fact that indexes of conductivity and resistance are reduced during the first few days after the operation if the trigeminal nerve is contusion or stretched, while the recovery of electrophysiological indexes takes 1-2 months after the operation [1]. If trigeminal nerve is completely or partially ruptured can be observed that indexes of conductivity and resistance are greatly reduced, while the tone rises. If trigeminal nerve is partially ruptured recovery of all electrophysiological indexes takes at least 6 months after the operation. If it is completely ruptured its electrophysiological indexes will not normalize even after 12 months since the operation.

That way we revealed that during postoperative period neuropathies of corresponding branches of trigeminal nerve with various severity and duration are observed and require adequate treatment.

Purpose of this undertaken research is to study the possibility of using hardware-software complex "DIN-1" in the complex treatment of neuropathies of II and III branches of the trigeminal nerve of varying severity (contusion, stretching, partial and complete rupture of the nerve) after tumor and tumor-like formations of jaws removal.

Material and Methods

We have made a research of neurological complications (neuropathies) of 146 patients after surgical interventions associated with the removal of tumors (ameloblastoma, osteoblastoma) and tumor-like formations (epidermoid, radicular, and folicular cysts, etc.) of upper and lower jaws. All of the 146 patients from the main group were divided into 4 groups: I group – 34 patients after operative intrusion (18 –

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upper jaw and 16 – lower jaw) with a nerve contusion; II group – 42 patients after surgeries (19 – upper jaw and 23 – lower jaw) with a stretched branches of trigeminal nerve; III group – 39 patients after operative intrusion (16 – upper jaw and 23 – lower jaw) with a partial rupture of one of the branches of trigeminal nerve; IV group – 31 patient after jaw resection operation (15 – upper jaw, and 16 – lower jaw) with a complete rupture of one of the branches of trigeminal nerve.

Control group was made of 179 patients after similar operative intrusions, but without hardware-software complex "DIN-1" used in complex treatment and 35 practically healthy patients (without any pathological processes in maxillofacial area).

Both main and control groups have received their surgical and postoperative medicated treatment in the Department of Maxillofacial Surgery of Shupyk National Medical Academy of Postgraduate Education.

All patients have undergone clinical methods of diagnosis which included: observation, palpation, anamsesis taking, jaw x-ray, etc. After operational intrusion selection of patients with corresponding postoperative injuries of trigeminal nerve branches was performed according to data received from "DIN-1" device. As was already said, hardware-software complex "DIN-1" was used for static and dynamic parameters of soft tissues, which are innervated by trigeminal nerve, measurement and complex treatment of neuropathies. All of the special examination of trigeminal nerve methods were made both during hospitalization and postoperative period.

Different treatment tactics are possible accordance to the world publications [29-33]. For treating neuropathies (from stretches, complete and partial rupture of trigeminal nerve) was used not only hardware-software complex "DIN-1" (in corresponding groups) but also a conventional medical therapy. Following medicaments were used: Nucleo CMP forte (Grupo Ferrer Internacional, S.A., Spain) and Neurovitan (Milgamma) (Hikma Pharmaceuticals PLC, Jordan)). These were appointed to our patients after consultation with neurologist. Nucleo CMF Forte in ampoules was adninistered intramuscularly once per day. Course lasted from 3 to 6 days. After that, treatment course was continued by taking the same medicament per os. Nucleo CMF Forte in 1-2 capsules 2 times per day for 10-20 days (10 – partial rupture, 20 – complete) was prescribed. Milgamma treatment went this way: we started from ml intramuscularly once per day, then switched to supportive therapy – 2 ml 2-3 times per week. There is a possibility of treatment with oral form of medicine (1 pill 3 times per day). Duration of treatment was 1 month. Neurovitan was appointed 2-4 pills per day to adults. Treatment course lasted 2-4 weeks.

I group did not take any medicine, they only were treated with hardware-software complex "DIN-1" (7 days per course). This complex was appointed only after 5-6 days since surgery, i.e. after postoperative edema of soft tissues greatly reduces. II group went through general medication course of early mentioned medicines 1 time (during 1st month). Hardware-software complex "DIN-1" was used 2 times during 1st month after the operation for this group (every electrostimulation course lasted 7 days with a 7 day break). III and IV groups went through general medication course 2 times during rehabilitation period, while trigeminal nerve electrostimulation courses, with use of "DIN-1" device, was performed 2 times during first month after operation and once per month afterwards. During few months we repeated electrostimulation course till electrophysiological indexes and clinical symptoms of neuropathies normalized. When weachieved full recovery of injured trigeminal nerve branch's sensitive functionwe stopped hardware-software complex "DIN-1"treatment [2-6]. After half a year since operation, we recommended those who did not completely recover from IV group to undertake 1 more general medication treatment course and pass electrostimulation course, with use of "DIN-1" device, monthly for 3 months.

Acquired patient examination data was processed using conventional variation-statistical method with personal computer and statistics program package "SPSS 11.0 for Windows" and "Microsoft Excel 2000". Reliability of results was estimated by Student criteria. Difference was considered reliable – $P < 0.05$.

Results

Earlier we found out electrophysiological indexes of soft tissues innervated by II and III branches of trigeminal nerve of generally healthy people. II branch conductivity index was 113.0 ± 2.8 conventional units (CU), resistance – 5.0 ± 0.7 CU and tone – 2.2 ± 0.1 CU. III branch conductivity index was 113.0 ± 2.8 CU, resistance – 5.0 ± 0.7 CU, and tone – 2.2 ± 0.1 CU [1].

That way you can see that indexes of conductivity, resistance and tone of II and III branches of trigeminal nerve of generally healthy people are almost identical. *Reliability of changes of electrophysiological indexes was measured according to those of generally healthy people.*

In I group (trigeminal nerve contusion) we saw changes of electrophysiological indexes during postoperative period of treatment. Indexes of conductivity (Fig 1) during hospitalization (before operation) were 117.3 ± 2.9 CU ($P > 0.05$), after 3 days – 79.9 ± 3.8 CU ($P < 0.001$), 7-8 days since the operation – 92.1 ± 2.9 CU ($P < 0.001$), 14-15 days – 107.8 ± 3.7 CU ($P > 0.05$). Indexes of resistance (Fig 2) during hospitalization were 5.3 ± 2.0 CU ($P > 0.05$), after 3 days – minus 8.1 ± 3.9 CU ($P < 0.001$), 7-8 days since the operation – minus 1.1 ± 0.3 CU ($P < 0.001$), 14-15 days – 4.9 ± 2.1 CU ($P > 0.05$). Indexes of tone (Fig 3) during hospitalization were 2.0 ± 0.3 CU ($P > 0.05$), after 3 days – 2.2 ± 0.4 CU ($P > 0.05$), 7-8 days since the operation – 2.3 ± 0.3 CU ($P > 0.05$), 14-15 days – 2.1 ± 0.2 CU ($P > 0.05$).

That way, with usage of hardware-software complex "DIN-1" in treatment of postoperative neuropathies, caused by bruise of II and III branches of trigeminal nerve, studied indexes of conductivity and resistance recovered after 14-15 days since the operation, not 1 month if treatment went without hardware-software complex "DIN-1" [1]. This means that complete recovery

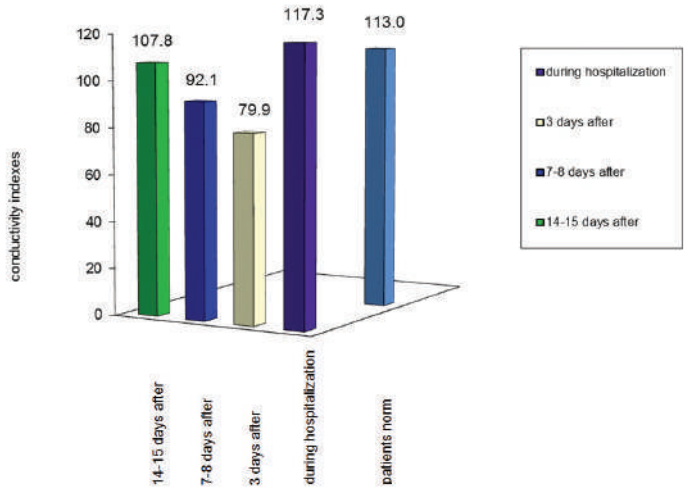

FIGURE 1. Indexes of conductivity of trigeminal nerve branches during treatment (I group).

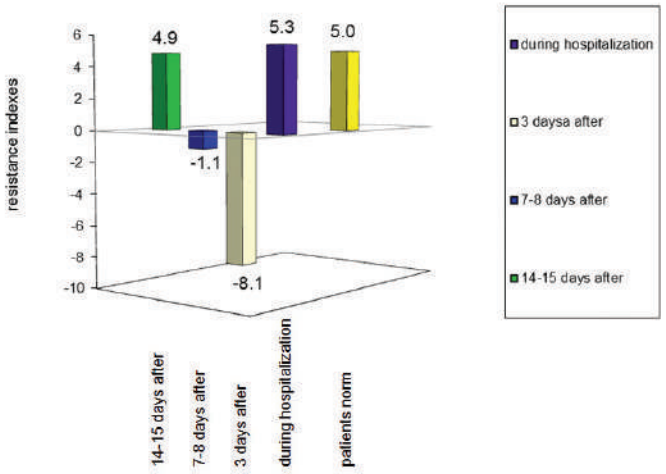

FIGURE 2. Indexes of resistance of trigeminal nerve branches during treatment (I group).

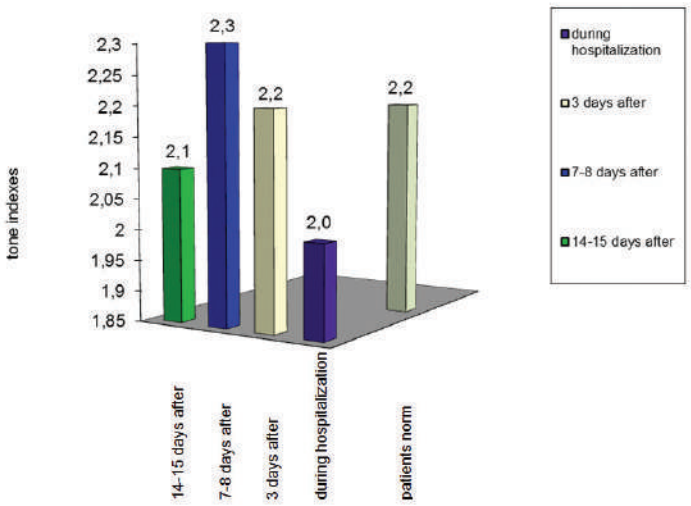

FIGURE 3. Indexes of tone of trigeminal nerve branches during treatment (I group).

of neuropathies, caused by bruise of II and III branches of trigeminal nerve, went twice as fast if hardware-software complex "DIN-1" was used during treatment.

While examining patients from II group (stretched trigeminal nerve) we have noticed changes to electrophysiological indexes during treatment. Indexes of conductivity (Fig 4) during hospitalization were 112.5 ± 3.8 CU (P > 0.05), after 3 days – 75.9 ± 4.7 CU (P < 0.001), 7-8 days since the operation – 86.7 ± 3.6 CU (P < 0.001), 1 month – 92.1 ± 2.1 CU (P < 0.001), 1,5 month – 115.2 ± 2.2 CU (P > 0.05). Indexes of resistance (Fig 5) during hospitalization were 7.4 ± 2.1 CU (P > 0.05), after 3 days – minus 8.3 ± 3.4 CU (P < 0.001), 7-8 days since the operation – minus 15.1 ± 2.7 CU (P < 0.001), 1 month – minus 1.2 ± 1.4 CU (P < 0.001), 1.5 month – 5.4 ± 2.9 CU (P > 0.05). Indexes of tone (Fig 6) during hospitalization were 2.2 ± 0.3 CU (P > 0.05), after 3 days – 2.7 ± 0.5 CU (P > 0.05), 7-8 days since the operation – 2.4 ± 0.6 CU (P > 0.05), 1 month – 2.2 ± 0.2 CU

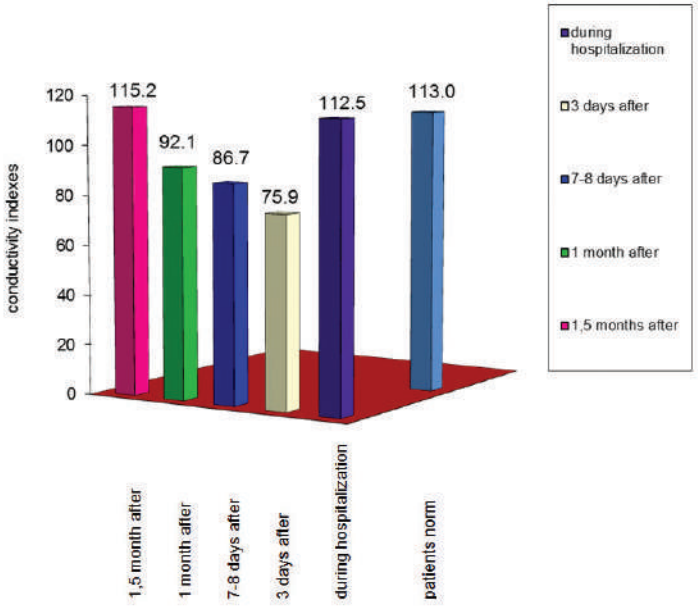

FIGURE 4. Indexes of conductivity of trigeminal nerve branches during treatment (II group)

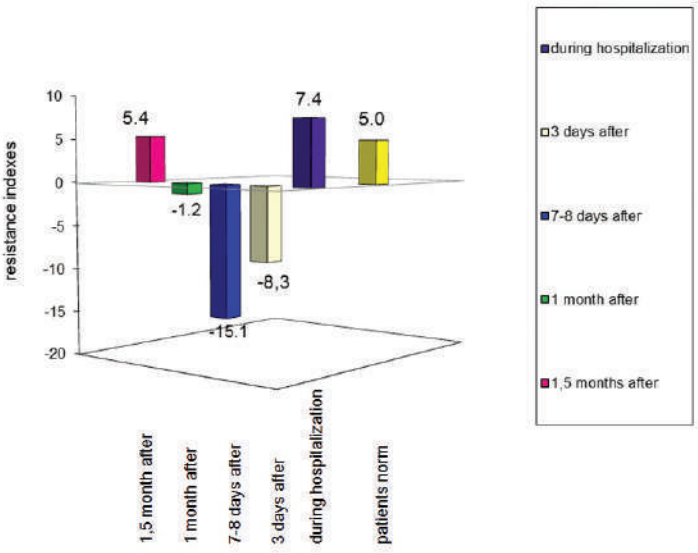

FIGURE 5. Indexes of resistance of trigeminal nerve branches during treatment (II group)

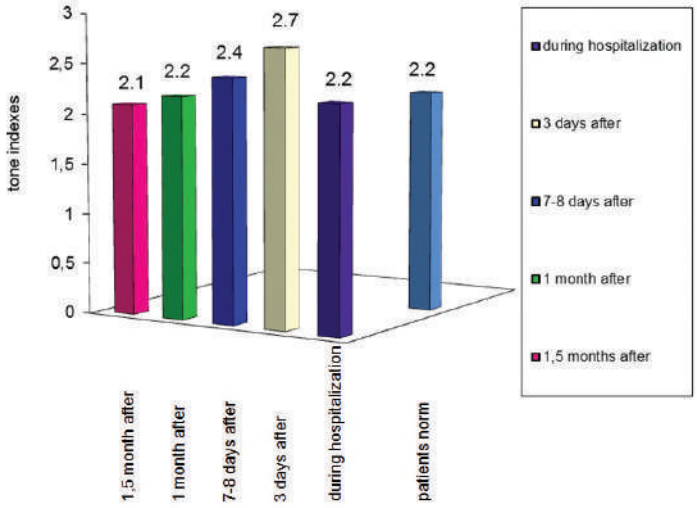

FIGURE 6. Indexes of tone of trigeminal nerve branches during treatment (II group)

(P > 0.05), 1.5 month – 2.1 ± 0.6 CU (P > 0.05).

That way, with usage of hardware-software complex "DIN-1" in treatment of postoperative neuropathies, caused by strain of II and III branches of trigeminal nerve, studied indexes of conductivity and resistance recovered after 1.5 month since the operation, not 2 months if treatment went without hardware-software complex "DIN-1" [1]. This means that complete recovery of neuropathies, caused by strain of II and III branches of trigeminal nerve, went 1.5 faster if hardware-software complex "DIN-1" was used during treatment.

While treating patients from III group (partially ruptured trigeminal nerve) we have noticed changes to electrophysiological indexes. Indexes of conductivity (Fig 7) during hospitalization – 117.2 ± 3.8 CU (P > 0.05), 3 days since the operation – 63.4 ± 4.9 CU (P < 0.001), after 14-15 days – 82.3 ± 3.1 CU (P < 0.001), 1 month since the operation – 88.3 ± 4.3 CU (P < 0.001), 3 months – 94.5 ± 4.3 CU (P < 0.02), 4 months – 111.5 ± 3.2 CU (P > 0.05). Indexes of resistance (Fig 8) during hospitalization – 5.3 ± 0.4 CU (P > 0.05), 3 days since the operation – minus 10.2 ± 3.7 CU (P <0,001), 14-15 days – minus 8.1 ± 2.6 CU (P < 0.001), 1 month since the operation – minus 3.9 ± 2.5 CU (P < 0.001), 3 months – 2.1 ± 1.7 CU (P < 0.01), 4 months – 4.9 ± 0.9 CU (P > 0.05). Indexes of tone (Fig 9) during hospitalization – 2.0 ± 0.3 CU (P > 0.05), 3 days since the operation – 3.1 ± 0.3 CU (P < 0,001), 14-15 days – 2.9 ± 0.2 CU (P < 0.001), 1 month since the operation – 2.6 ± 0.2 CU (P < 0.02), 3 months – 2.2 ± 0.1 CU (P > 0.05), 6 months – 2.1 ± 0.2 CU (P > 0.05).

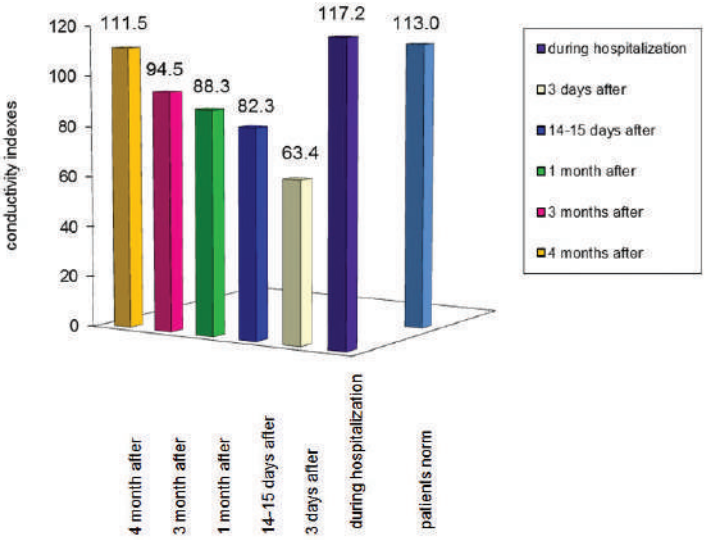

FIGURE 7. Indexes of conductivity of trigeminal nerve branches during treatment (III group)

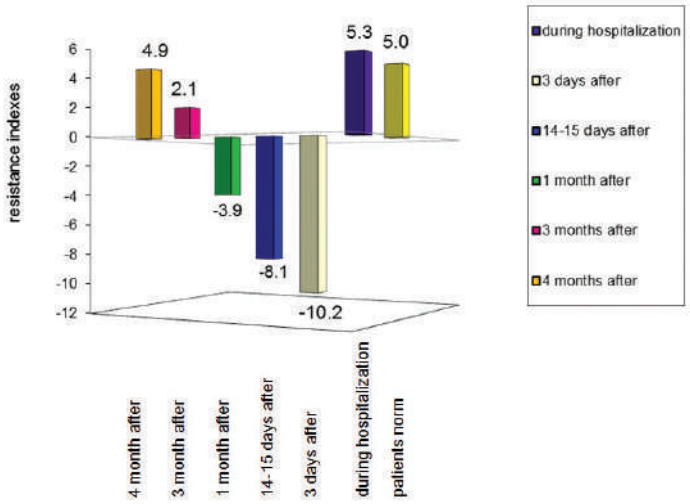

FIGURE 8. Indexes of resistance of trigeminal nerve branches during treatment (III group)

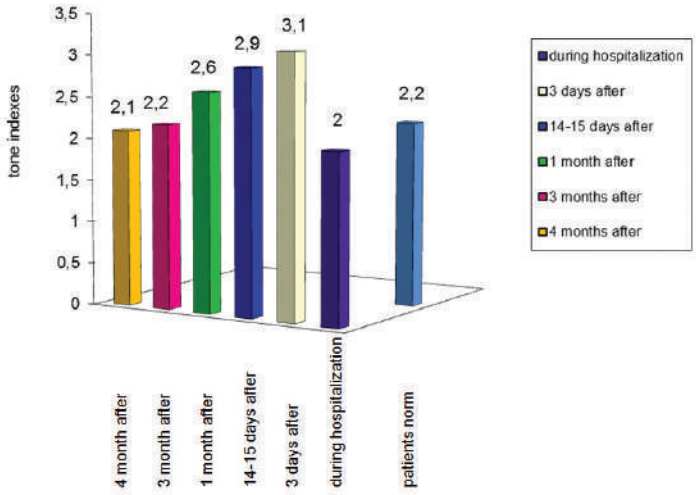

FIGURE 9. Indexes of tone of trigeminal nerve branches during treatment (III group)

That way, with usage of hardware-software complex "DIN-1" in treatment of postoperative neuropathies, caused by partial rupture of II and III branches of trigeminal nerve, studied indexes of conductivity, resistance and tone recovered after 4 months since the operation, not 6 months if treatment went without hardware-software complex "DIN-1" [1]. Usage of hardware-software complex "DIN-1" during medicated treatment allowed 97.4% of patients with partial trigeminal nerve rupture to completely recover after the operation. This means that recovery went 1.5 faster if hardware-software complex "DIN-1" was used. And only 2.6% of patients recovered after 6 months since the operation.

During our examination of IV group (complete rupture of one of the trigeminal nerve branches) patient we have noticed a substantial change of electrophysiological indexes during treatment. Indexes of conductivity (Fig 10) during hospitalization – 114,8 ± 3,9 c.u. ($p > 0,05$), 3 days after the operation – 54.2 ± 4.7 CU ($P < 0.001$), 14-15 days – 52.7 ± 6.9 CU ($P < 0.001$), 1 month since the operation – 68.6 ± 5.8 CU ($P < 0.001$), 3 months – 89.4 ± 6.5 CU ($P < 0.001$), 6 months – 99.3 ± 11.2 CU ($P > 0.05$). Indexes of resistance (Fig 11) during hospitalization – 5.2 ± 0.7 CU ($P > 0.05$), 3 days after the operation – minus 19.9 ± 4.1 CU ($P < 0.001$), 14-15 days – minus 22.6 ± 6.1 CU ($P < 0.001$), 1 month since the operation – minus 27.9 ± 6.0 CU ($P < 0.001$), 3 months – minus 10.2 ± 5.8 CU ($P < 0.001$), 6 months – minus 4.3 ± 4.8 CU ($P < 0.02$).

Indexes of tone (Fig 12) during hospitalization – 2.4 ± 0.2 CU ($P > 0.05$), 3 days after the operation – 3.1 ± 0.2 CU ($P < 0.001$), 15 days – 3.2 ± 0.3 CU ($P < 0.001$), 1 month since the operation – 2.9 ± 0.3 CU ($P < 0.001$), 3 months – 2.7 ± 0.2 CU ($P < 0.001$), 6 months – 2.6 ± 0.1 CU ($P < 0.05$).

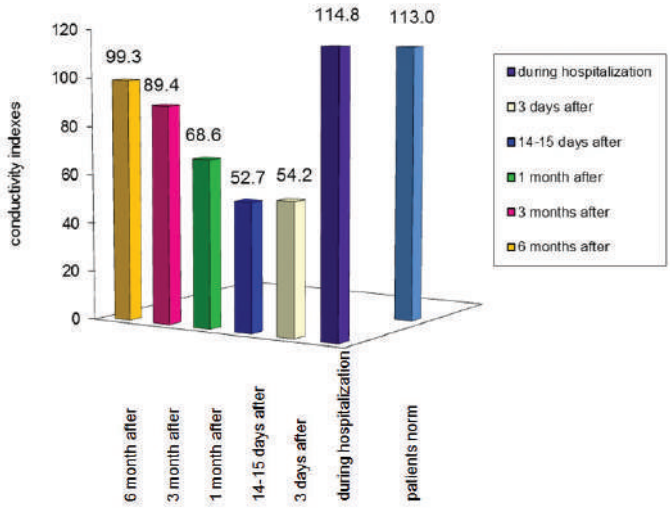

FIGURE 10. Indexes of conductivity of trigeminal nerve branches during treatment (IV group)

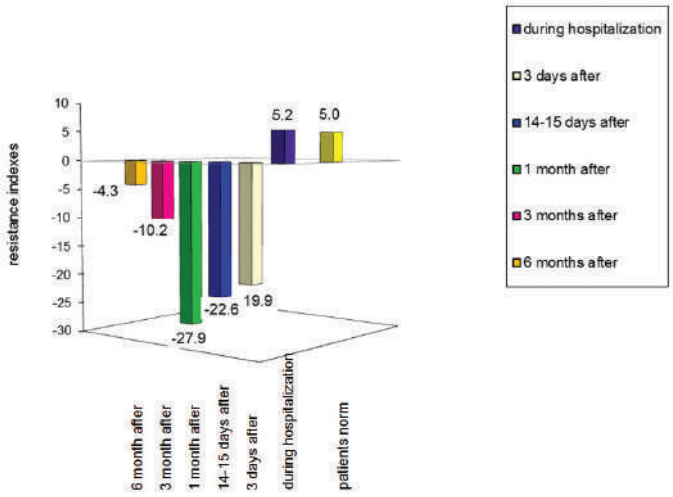

FIGURE 11. Indexes of resistance of trigeminal nerve branches during treatment (IV group)

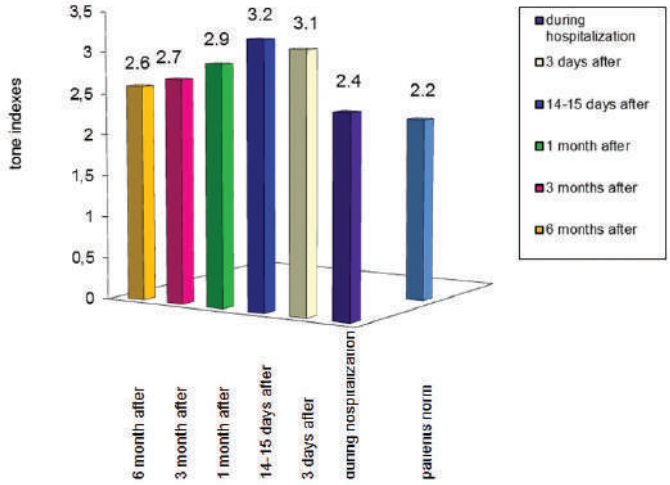

FIGURE 12. Indexes of tone of trigeminal nerve branches during treatment (IV group)

That way, with usage of hardware-software complex "DIN-1" in treatment of postoperative neuropathies, caused by complete rupture of II and III branches of trigeminal nerve, 17 of 31 (54.8%) patients recovered the studied indexes of conductivity, resistance and tone after 6 months since the operation. 45.2% of patients continued the treatment. We repeated clinical examination of these patients after 1 year. 8 more patients (25.8%) had recovered their electrophysiological indexes. Therefore, we registered that 80.6% of patients have recovered after complete postoperative rupture of trigeminal nerve branches 1 year since the operation, using our recommended method. It should be noted that according to literature [4, 5] using conventional treatment normalization of skin and oral cavity mucosa sensitivity after complete rupture of trigeminal nerve branches (1 year since the operation) was registered in less than 20% of cases.

While analyzing the results of examination of patients with postoperative neuropathies of II and III branches of trigeminal nerve of varying severity (contusion, stretching, partial and complete rupture) we have come to the conclusion that our recommended method of treatment is highly efficient.

Usage of hardware-software complex "DIN-1" allowed patients with neuropathies, caused by bruised trigeminal nerve, to completely recover after 14-15 days since the operation and the treatment went 2 times faster than without it.

Usage of hardware-software complex "DIN-1" in complex medicated treatment allowed patients with neuropathies, caused by strained trigeminal nerve, to completely recover after 1.5 month since the operation and the treatment went 1.5 times faster than without it.

Usage of hardware-software complex "DIN-1" in complex medicated treatment allowed 97.4% of patients with neuropathies, caused by partial trigeminal nerve rupture, to completely recover after 4 months since the operation and the treatment went 1.5 times faster than without it. Only 2.6% of the cases we registered complete recovery after 6 months since the operation.

Usage of hardware-software complex "DIN-1" in complex medicated treatment allowed 54.8% of patients with neuropathies, caused by complete trigeminal nerve rupture, to completely recover skin and oral cavity mucosa sensitivity after 6 months since the operation. 1 year after 25.8% more patients have recovered. That way, using or recommended method of treatment, we have registered that 80.6% of the patients have recovered after complete rupture of trigeminal nerve branches 1 year since the operation. While according to literature [4, 5], complete recovery of skin and oral cavity mucosa sensitivity after complete trigeminal nerve rupture 1 year since the operation is observed in less than 20% of the cases.

Conclusion

Based on examination, it was found that using hardware-software complex "DIN-1" in treatment allowed to shorten the treatment of patients with neuropathies caused by bruise of II and III trigeminal nerve branches by 2 times. Using hardware-software complex "DIN-1" in treatment allowed to shorten the treatment of patients with neuropathies caused by strain of II and III trigeminal nerve branches by 1.5 times and 97.4% of patients with neuropathies caused by partial rupture of this nerve recovered after 4 months since the operation. Usage of hardware-software complex "DIN-1" in treatment allowed 80.6% of patients with neuropathies caused by complete rupture trigeminal nerve branches to achieve clinical recovery (54.8% – after 6 months, and 25.8% – 1 year since the operation).

That way, usage of hardware-software complex "DIN-1" in treating neoplasms of the jaws has not only diagnostic and prognostic meaning but also drastically increases effectiveness of treating patients with neuropathies of trigeminal nerve, which occur in postoperative period.

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Conflict of Interests

The authors declare no conflict of interest.

Role of Author and Co-authors

Oleksii O. Tymofieiev (concept of the paper and writing).
Natalia O. Ushko (material collection and editing).
Olena P. Vesova (material collection).
Mariia O. Yarifa (material collection).

Ethical Approval

Approval was obtained from the Medical Ethics Committee of the Shupyk National Medical Academy of Postgraduate Education, Kyiv, Ukraine.

Patient Consent

Not required.

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Лікування післяопераційних нейропатій трійчастого нерва

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ПРО СТАТТЮ

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Електрофізіологічні показники
Забій трійчастого нерва
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Повний і неповний розрив нервів
Неврологічні ускладнення
Пухлини щелеп
Пухлиноподібні утворення щелеп

РЕЗЮМЕ

Мета. Вивчити можливості застосування апаратно-програмного комплексу "ДІН-1" в комплексному лікуванні нейропатій II і III гілок трійчастого нерва різного ступеня тяжкості (при забитті, розтягу, частковому та повному розриві нерва) у хворих після проведення операцій видалення пухлин і пухлиноподібних утворень щелеп.

Методи. Проведено лікування неврологічних ускладнень у 146 пацієнтів після проведення оперативних втручань, пов'язаних з видаленням пухлин і пухлоподібних утворень верхньої та нижньої щелеп з використанням програмно-апаратного комплексу "ДІН-1".

Результати. На підставі проведеного обстеження встановлено, що використання аппаратно-програмного комплексу "ДІН-1" у комплексному лікуванні нейропатії трійкового нерва у хворих після проведених операцій видалення пухлин і пухлиноподібних утворень органів має високу терапевтичну ефективність.

Висновки. Отримані нами дані можна використовувати в комплексному лікуванні нейропатий II і III гілок трійчастого нерва різного ступеня тяжкості (забиття, розтягнення, частковий і повний розрив нерва) у хворих після проведення операцій видалення пухлин і пухлиноподібних утворень щелеп.

Лечение послеоперационных нейропатий тройничного нерва

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Электрофизиологические показатели
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Растяжение тройничного нерва
Полный и неполный разрыв нерва
Неврологические осложнения
Опухоли челюсти
Опухолевые образования челюстей

РЕЗЮМЕ

Цель. Изучить возможности применения аппаратно-программного комплекса "ДИН-1" в комплексном лечении нейропатий II и III ветвей тройничного нерва разной степени тяжести (при ушибе, растяжении, частичном и полном разрыве нерва) у больных после проведения операций удаления опухолей и опухолеподобных образований челюстей.

Методы. Проведено лечение неврологических осложнений у 146 больных после проведения оперативных вмешательств, связанных с удалением опухолей и опухолеподобных образований верхней и нижней челюстей с применением аппаратно-программного комплекса "ДИН-1".

Результаты. На основании проведенного обследования установлено, что использование аппаратно-программного комплекса "ДИН-1" в комплексном лечении нейропатий тройничного нерва у больных после проведенных операций удаления опухолей и опухолеподобных образований челюстей имеет высокую терапевтическую эффективность.

Выводы. Полученные нами данные можно использовать в комплексном лечении нейропатий II и III ветвей тройничного нерва разной степени тяжести (ушиб, растяжение, частичный и полный разрыв нерва) у больных после проведения операций удаления опухолей и опухолеподобных образований челюстей.