

Conference paper

## Treatment of Bilateral Damages of Temporomandibular Joints by TiNi-based Materials

I.G Aleshkin<sup>1</sup>, V.A Karnaukhov<sup>1</sup>, A.T. Karnaukhov<sup>1\*</sup>

\*Corresponding author:  
A.T. Karnaukhov, email:  
Karnaukhov41@mail.ru

<sup>1</sup> Irkutsk State Medical University, Irkutsk, Russia

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### Abstract

The replantation is recommended and the efficiency of it is proved by the observations of patients after surgical interventions up to 8 years. The resistant anatomic integrity of the lower jaw and of temporomandibular joints and the functional rehabilitation of patients after a trauma are reached.

### 1 Introduction

The frequency of injuries of a facial part of the skull has increased by 2-3 times during last decade. According to the authors [1, 6] the lower jaw fractures make about 85% of injuries of jaws, among which the fractures of condylar shoots make from 6.4 – 44.7% [2] of total number of fractures, including with dislocation of an articular head, with damages of temporomandibular joint.

8-19% fall to the share of bilateral damages [1, 3], followed by the clear anatomy-functional changes and quite often at conservative treatment they lead to violation of a bite, to development of a contracture or ankyloses of temporomandibular joints. All this testifies to expediency of development of surgical methods of treatment of these damages [2, 4].

Using of hi-tech methods of a research three-dimensional images (3D), magnetic resonance imaging (MRI) multislice computed tomography (multislice CT) and volume digital dental tomographs (VDDH) have considerably changed possibilities of radial diagnostics to obtain significant diagnostic information of pathology of temporomandibular joints. [3, 5]

### 2 Experiment

To improve the results of surgical treatment of patients with bilateral injuries of a temporomandibular joint by using the shape memory titanium nickel alloy material of thermomechanical processing. To give the nearest and distant (8 years) outcomes of treatment.

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The clinical material of the work is based on the experience of the investigation and the treatment of 22 patients with high damages of the condylar shoot, with the fracture and dislocation of an articular head of the temporomandibular joint. The people were the patients of the clinic of maxillofacial surgery of the Irkutsk State Medical University from 2005 for 2016.

The access to the temporomandibular joint was got by cutting the skin from the earlobe fringing a jaw corner taking into account a marginal branch of a facial nerve (with the length of 4-5m) and we got the joint layer-by-layer. We have made modeling of a replantat of a condyle with the articular head according to the offered technique to 22 patients with this pathology.

The technique of modeling of the replantat was carried out with mini brackets of 4-5mm (length), 0,5-0,9mm (thickness) made from the shape memory titanium nickel alloy (TiNi). We fixed the articular head in three levels to the line of the fracture of the condyle and the immobilization of a replantat with brackets was strictly perpendicularly to the fragment of the jaw branch.

The formation and fixing of the replantat to the branch of a jaw with brackets carried out at an 90° angle that allows to fix the replantat in a proper correlation with the branch of the jaw and the head of a joint is input into the articular pole on the disk.

The osteosynthesis of a replantat to a branch of the jaw was carried out with omega and S shape brackets [2-3pieces ] with shape memory bicortically and strictly perpendicular to the line of an osteotomy.

As a result of the treatment of fractures of the condylar shoot with the offered technique the complete recovery of function at 19 (95,7%) cases has reached. The patients ate liquid food, the movements of the lower jaw were free and painless already in two days after surgery, the chewing function was restored in 5-7days.

Patient A., 26 years, (medical record No. 318), has come to the maxillofacial department of the Irkutsk city hospital No. 18.03.2009 year with complaints to pains when opening the mouth and violation of the bite of teeth.

Diagnosis: The close craniocerebral injury, bilateral intra articulate fracture with dislocation of the articular heads. While being examined the violations of the movement of the lower jaw are revealed, the articularheads weren't defined with palpation, the opening of was mouth was followed by a pain syndrome. On the multislice computed tomography (multislice CT) on thefrontal reformates, on the sagittal slices high intra articulate fractures of the condylar shoots with bilateral dislocation of the articular headsdisplaced by external wing-shaped muscles to a

wedge-shaped bone of the external skull base by the fracture of frontal department of the lower jaw are defined.

Fig. 1. The reconstructive – recovery operations with consecutive bilateral modeling of replantats of the mandibular joint are carried out according to the developed technique.



Figure 1 – Patient A. 26 years. MSKT on coronary reformat there is bilateral fracture with dislocation, with the shift of the articularheads of the temporomandibular joint to the external basis of theskull; there is a fracture of the mental part of the lower jaw.



Figure 2 – Patient of A.26 of years. The result of bilateral modeling of the replantats of the condylar shoot of the temporomandibular joint with TiNi brackets

Fig. 2. Postoperative clinical course was smooth, considering bilateral injury of mandibular joints, the immobilization of jaws was required for a week with the preventive purpose. The patient was discharged with the complete recovery of the function of mandibular joints and with anatomic integrity of the lower jaw.

Reconstruction, computed tomography (multislice CT) after 8 years of observation of the patient A. 35 years. 22.02.2016.

On fig.3 computed tomography (multislice CT) the structure of a replantat is without violations, the brackets are integrated with the bone. The patient doesn't have any complaints. The function of the movement of the lower jaw in temporomandibular joints has been restored completely.

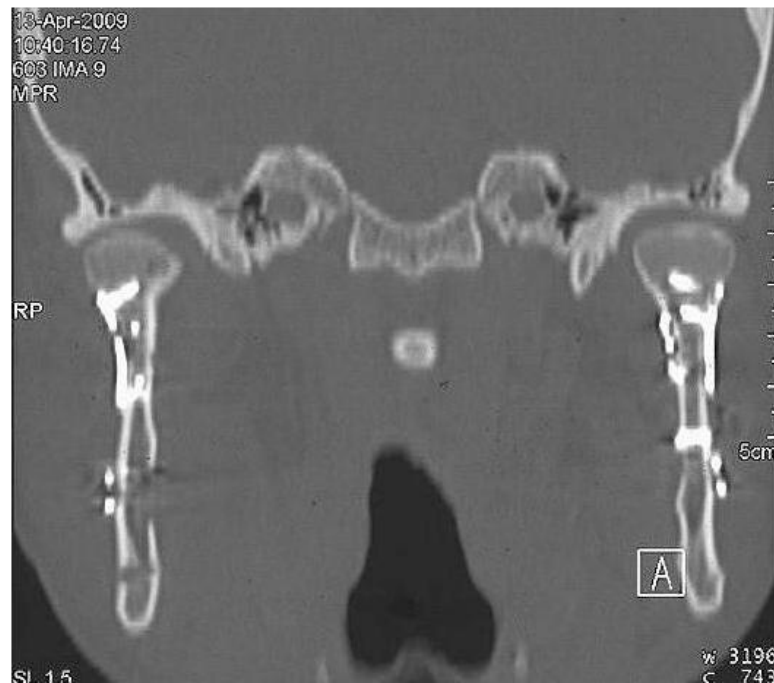


Figure 3 – Patient of A.35 of years. After 8 years of observation we can see the reconstruction of the computed tomography (multislice CT) on coronary reformat as the result of bilateral modeling of a replantat of the temporomandibular joint with TiNi brackets

### 3 Conclusion.

1. The using of computer technologies such as multislice computed tomography (multislice CT) with the three-dimensional image (3D) have considerably changed the possibilities of radiodiagnosis in obtaining significant diagnostic information of the radiographic benefit.

These technologies are the leading methods of identification of pathological changes at a cranial and maxillofacial injury of the articulate disk, the intraarticular ligaments, the bilaminar zone in temporomandibular joint and further planning of treatment of pathology of the temporomandibular joint.

2. The using of immersible fixation device made from the shape memory titanium nickel alloy (TiNi) for the osteosynthesis at a replantation of the condylar shoot allows to keep the function of the temporomandibular joint at the rather stable immobilization of the jaw fragments and moderate compression effect.
3. The replantation of the temporomandibular joints of adults takes about 1 month, then there is the wrong regeneration of the fragments of the injured joint and the formation of various forms of an ankylosis of the temporomandibular joint.
4. The remote results of our clinical observations ( for 8 years) allow us to conclude that there is the expediency of using of these technologies and clamps made from the shape memory titanium nickel alloy (TiNi) of thermomechanical processing for the osteosynthesis and the replantation of pathology of the temporomandibular jointsof adult patients.

## 4 Acknowledgments

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