

Conference paper

Removal of Temporomandibular Joint Bone Ankylosis by Shape Memory Materials

M.Sh. Mirzoev^{1*}, D.I. Khushvakhtov¹, S.A. Safarov¹, I.Kh. Mangutov¹, A.M. Olimov¹,
M.N. Schakirov¹

¹ SEI Institute of Postgraduate Health Education of Republic of Tajikistan,
Department of maxillofacial surgery with child's stomatology, Tajikistan

Abstract

A special attention has been attracted by the method of endoprosthesis replacement of temporomandibular joint. This research is devoted to an increase of surgical treatment efficiency of temporomandibular joint bone ankylosis using porous titanium nickel endoprostheses. The analysis of distant results of application of porous nickelid titanium endoprostheses for replacement of mandibular condylar processes in patients with temporomandibular ankylosis affects, according to anatomical specifics of affected organ, allows to make conclusion on possibility of complete restoration of lost anatomical and functional specifics of dentomaxilla apparatus. Through correspondence of hysteresis behavior of lost organ and recipient tissues to hysteresis behavior of whole complex system of endoprosthesis, the connecting tissues from implant surrounding areas grow through porous structure of implant not causing any aggressive reactions from organism side.

*Corresponding author:
Mirzoev, email:
mirzoev_1965@bk.ru

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1 Introduction

Rehabilitation of patients with temporomandibular joint impairments is one of the relevant and complicated problems in maxillofacial surgery. Presence of this pathology is often accompanied by pain syndrome, anatomic and functional disorders of masticatory apparatus. Conservative therapy of this type of patients, in most of the cases, doesn't lead to recovery [4]. This type makes people with destructive changes of mandible head of inflammation character, and also its traumatic damages, habitual dislocations of mandible and other inner joint disorders during inefficiency of conservative treatment, temporomandibular osteoarthritis deformations, temporomandibular joint ankylosis, swelling and swelling-like affects.

Today the large number of bone and plastic surgeries directed for reconstruction of temporomandibular joint with application of auto- and different type of allografts including their combinations have been developed for restoration of mandible head [7, 8, 10]. However, these methods aren't fully able to solve the problem the

specialists face because of illness recurrences since transplanted materials are torn away and resorbed. Therefore, a special attention has been attracted by the method of endoprosthesis replacement of temporomandibular joint. With this aim, most of the specialists use stainless steel, vitallium, titanium, chrome and cobalt alloy, polymer, silicone, ceramics and other type implants which don't have delay effect [1, 3, 5, 6, 9]. It is known that indicated materials are torn away after placing in tissue defects or act like foreign bodies. That is why, today, replacement of head of temporomandibular joint, branch and body of mandibular in individuals with indicated pathologies, with the aim of restoration and normalization of anatomical and functional specifics of dentomaxillar apparatus is implemented by titanium nickel endoprotheseses.

Theaimofresearchisanincreaseofsurgicaltreatmentefficiencyoftemporomandibular joint bone ankylosis using porous titanium nickel endoprotheseses.

2 Materials and method

Today, materials on the base of titanium nickel are widely used in different medical spheres because of their physico-mechanical properties which are close to organism tissue. Can be related to them: hysteresis behavior, absence of chemical reactions during tissue injections, change of forms during tension and temperature changes, damping correspondence of material properties to biological tissues, porous transparency properties for cell and tissue structures, correspondence to capillary and material moistening correspondence to tissue characteristics, ability to incubate with further organ function support, function reliability in organism in sign changing load effect conditions, absence of sterilization problems.[2].

Clinical work results are based on in section and treatment experience of 10 patients in the age of 13 to 40 with two-sided temporomandibular joint bone ankylosis who were on treatment in adult maxillofacial surgery department of State Medical Center of Republic of Tajikistan (SMCRT). All of the patients went through clinical and microbiological inspections according to standard scheme (general blood test, biochemical blood test, coagulogram, blood examination for RW, HCV, HbS-antigen, HIV infection, blood group). In all of the cases, the mentioned condition was accompanied with mandibular micrognathia.

Endoprosthesis of mandibular branch which has right and left option including head of temporomandibular joint made of porous and not porous materials on the base of titanium nickel consisting of super elastic perforated plate which is fixed with similar to form and size permeable porous parts from both sides has been developed in Scientific and Research Institute of medical materials and shape-form implants

(Tomsk, Russian Federation). Ononeside, construction has polished thickness which corresponds to mandibular head configuration (Fig. 1). Sizes and configuration of endoprosthesis were identified individually on the base of roentgeologic examinations (orthopantomogram of jaws, spiral computed tomography – layer-base and large pictures).

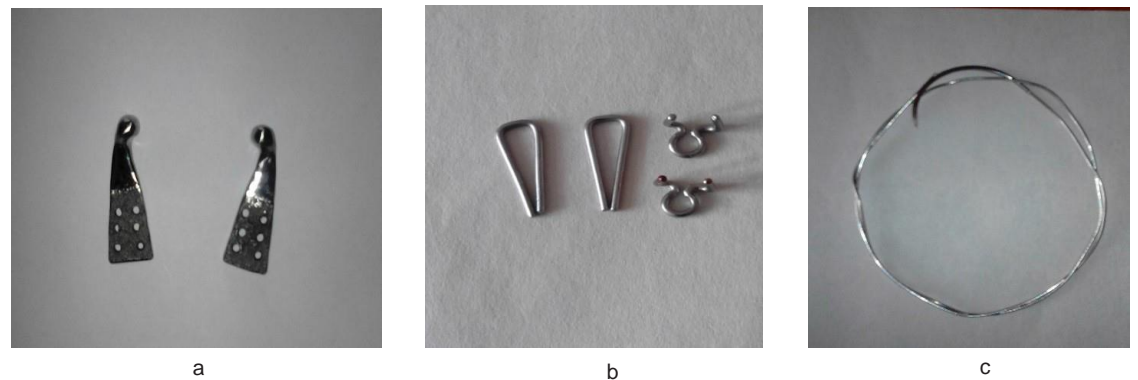


Figure 1 – a – endoprosthesises of mandibular head and branch (right and left options); b – fixing constructions with shape-form alloys; c – tantalum wire for endoprosthesis fixing

3 Surgery technics

The access to affection area as well as exposure of branch back, corner and back border of mandible were done from behind the jaw and under mandibular. Affected structures of condylar and coronoid processes were removed by horizontal osteotomy on mandibular cut level, and bed for endoprosthesis and joint slots were formed. In last case, bone traumatic surface was isolated by pieces of temporal muscle and from the top by nickelid titanium tissue implant of 40-60 micrometer thickness with cell size of 1.0x1.0-3.0x3.0 mm. Similar intervention was conducted from the opposite side. Central fragment was placed in front reaching optimal position. Endoprosthesises were placed in infratemporal location, in ready bed with head in jointslot direction and were fixed to decorticated part of mandibular branch from outer surface side with the help of fixing nickelid titanium structures of shape-form alloy or tantalum wiring. Medial pterygoid and masseter muscle were together sutured from both sides. Wound was sutured layer by layer, drained for 2-3 days. Post surgical treatment of patients is according to general practice directed to early functional load.

4 Research results

According to aforementioned technology, patients went through two-sided endoprosthesis replacement of mandibular branch including head with replacement

of central fragment of jaw to front. Further rehabilitation activities depending on indications included mouth sanitation, orthodontic and orthopedic treatment with application of traditional technologies. All of the patients had favorable postsurgical period. None of significant complications were observed. Closest postsurgical period was accompanied by insignificant inflammatory reaction in intervention zone which mostly was eliminated on 5-8 day and primary wound healing was identified. While eliminating inflammatory occurrences and swelling of tissues in intervention area, the mandibular movement was restoring. After 1-1.5 months and more, there were no complaints, movements of mandible were full and no functional disorders from temporomandibular joints were identified. Roentgenologically, the position of endoprostheses is satisfactory and no destructive changes from recipient bone tissue were identified. Such occurrences as rupture of endoprosthesis through soft tissues to mouth or outside, break and migration of placed construction and fixing elements weren't observed.

For illustration purposes for provide the clinical case.

Patient K, 39 years old, addressed with complaints on full limit of mouth opening, food intake disorder and cosmetic lack of face (Fig. 2). According to anamnesis: 29 years ago she went through mandibular osteomyelitis surgery from both sides in the department of maxillofacial surgery of SCH in Dushanbe. There was no effect from the conducted treatment. Before addressing to department of maxillofacial surgery of SMC of RT, she didn't have any prior treatment. According to developed technology, she had two-sided removal of pathologic bone conglomerate with replacement of mandibular branch including heads by titanium nickel endoprostheses after replacement of central fragment to front (Fig. 3).

When examining after 3-6 months, patient didn't have any complaints. Mouth opening was full, side movements of mandible weren't limited, functional disorders from dentomaxilla apparatus weren't identified. Roentgenologically, her condition was satisfactory (Fig. 4).

5 Conclusion

Thus, analysis of distant results of application of porous nickelid titanium endoprostheses for replacement of mandibular condylar processes in patients with temporomandibular ankylosis affects, made according to anatomical specifics of affected organ, allows to make conclusion on possibility of complete restoration of lost anatomical and functional specifics of dentomaxilla apparatus. Through correspondence of hysteresis behavior of lost organ and recipient tissues to hysteresis

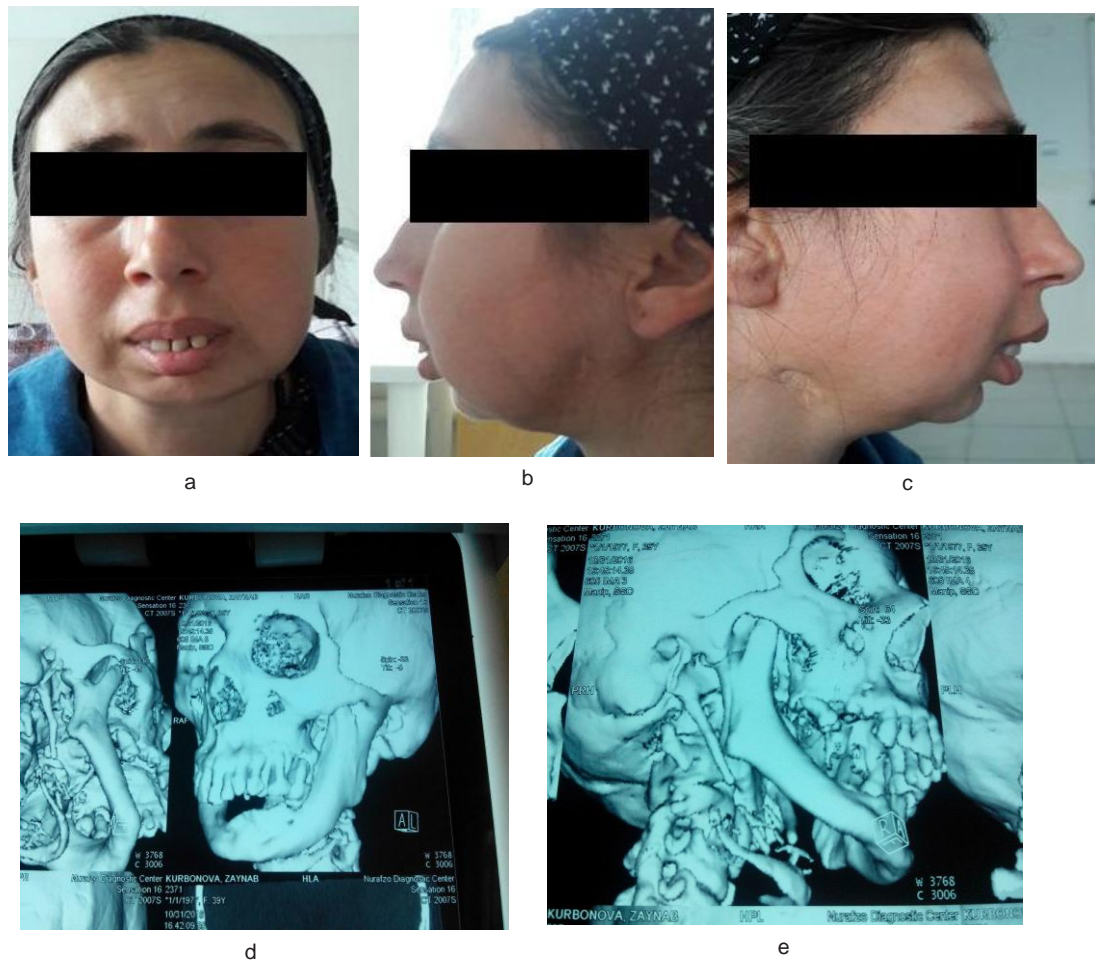


Fig. 2. – Patient K. 39 years old. Diagnosis – Two-sided bone ankylosis of temporomandibular joint; before surgery: a – direct projection; b,c – right and left lateral projection; d,e – roentgenologic picture

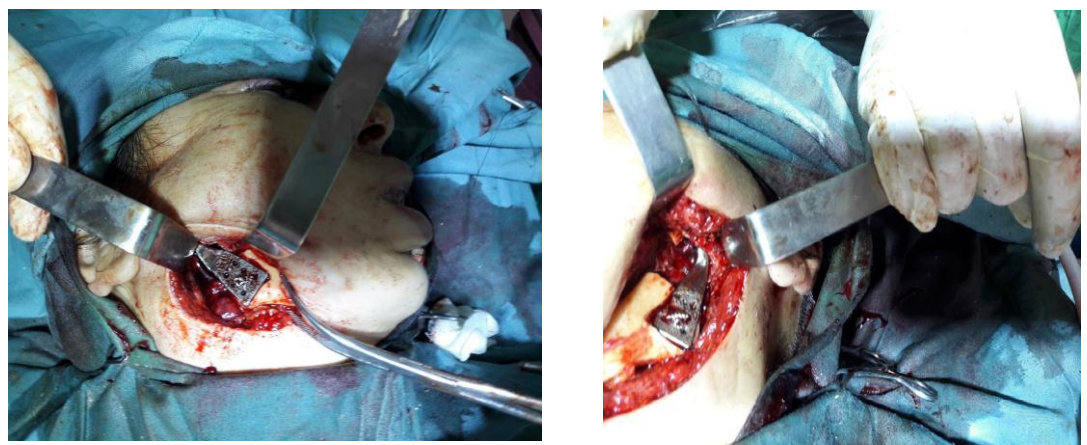


Fig. 3. – Patient K. Condition of surgery wound after fixation of endoprostheses of mandibular branches

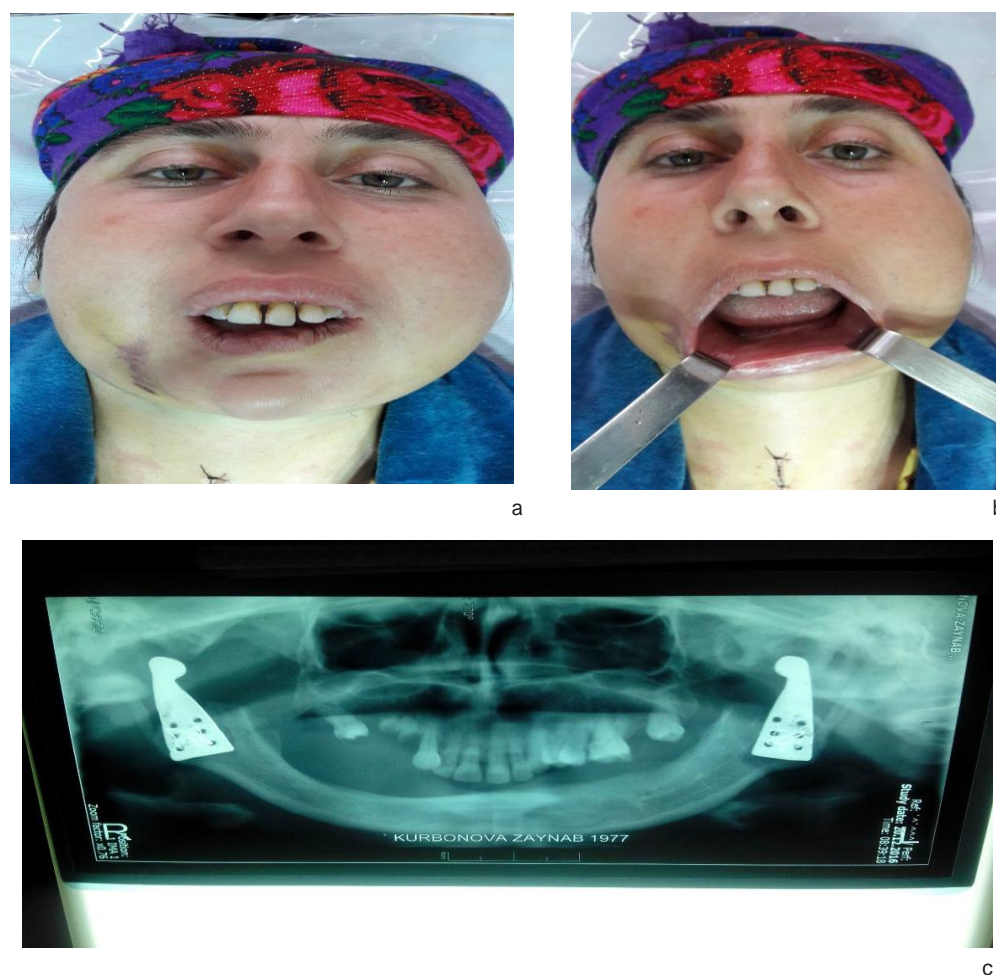


Fig. 4. – Patient K. Condition after endoprosthesis replacement of mandibular branches: a – front projection; b – open mouth condition; c – roentgenologic picture

behavior of whole complex system of endoprosthesis, the connecting tissues from implant surrounding areas grow through porous structure of implant not causing any aggressive reactions from organism side.

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