

Conference paper

Surgical Removal of Defects in the Palate with the Use of TiNi Mesh

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Abstract

Application of a thin-profiled mesh NiTi with filaments thickness of 40 micrometer and with the cell size of 3x3-5x5 mm for patients allows to improve the quality of the surgical technique in conducting surgical procedures for eliminating different forms and sizes of the palate defects. Due to its biochemical, biophysical compatibility with the body tissues and the peculiar integration properties a connective tissue grows around and through the structure of the implant by forming a durable frame. At the same time this process takes place by type of covering the muco-periosteal cover from the wound periphery to the center of the palate, over the implant material and completes with the full elimination of the existing defect. The developed method should be considered as minimally invasive surgical techniques and is recommended as a method of choice for patients with various background diseases.

1 Introduction

Defects in hard and soft palate are caused by prior surgical interventions for traumatic injuries of gunshot and non-gunshot origin, purulent inflammatory and specific diseases [1, 2, 3]. The bulk of the patients having defects of hard and soft palate are children who have previously been operated for congenital cleft palate [3, 7, 9]. It should be noted that the key role in recovery of mentioned patients is given to methods of plastic elimination, which directly affects the final result. It is known that the task of carrying out surgical procedures mentioned above include full restoration of the anatomic completeness of the palate with an adequate closing function of velopharyngeal ring [2, 4, 6]. However, in the postoperative period some patients have some defects in the hard and soft palate due to inconsistency of stitches caused by various reasons, and the defects are mainly

localized on the border of hard and soft palate [5, 6, 9]. Currently, to eliminate these defects are used surgical methods of treatment involving the use of local tissues and their combination with free skin graft, mucous-muscle flaps, formed from the tongue, cheeks, nasolabial folds, and etc. It should be noted that not all of the proposed methods allow achieving the desired results due to their insufficient effectiveness. In recent years, a number of authors [3, 5] have successfully developed a technology to eliminate defects of palate by using a mesh nickelid titanium in combination with the pedicle flap withdrawn from the tongue and there have been noted good results. However, the additional trauma caused to the patient during the withdrawal of flap from the tongue, impossibility of full hygienic oral care in the postoperative period make it in convenient, and the phase of cutting off pedicle flap from the tongue extend the period of treatment and rehabilitation. Based on these data, we have developed a modified version of the elimination of palate defects by using mesh nickelid titanium. The objective of the research is to increase the efficiency of surgical treatment of patients with palate defects.

2 Materials and Methods

During the period from 2012 till 2015 in the department of oral and maxillofacial surgery of the National Medical Center of the Republic of Tajikistan, 17 patients with defects located in different parts of the hard and soft palate were examined and treated. The age of patients ranged from 10 to 25 years old. Of the total number of patients, 9(52.94%) were men and 8 women (47.05%). 3 patients, aged 18-25, had defects in the front section of the palate and the defects were gunshot wounds caused by the suicide act. 11 patients, aged 10-17, had palate defects located in the middle of the palate section mainly on the border of line "A", which occurred at different times after surgery interventions in the congenital cleft of hard and soft palate. 3 patients had defects of the alveolar bone of the upper jaw caused by inconsistency of stitches in the area of operating wound after their plastic surgery. The defect sizes were different and ranged from 0,3x0,5cm in width up to 2.0x3.0cm in length and reached 2.0x3.0 cm in width and 3.0x4.0 cm in length. Moreover, their configurations were different and were represented by fissured-oval to round. All patients have been examined by a traditional scheme by conducting general clinical, clinical and laboratory research methods.

When planning for surgery for patients who had big-scale defects previously, in the laboratory a protective plate have been made of soft transparent plastic to protect the postoperative part of the palate. As for the eliminating the small-scale defects there was no need in manufacturing protective plates. In order to eliminate defects in the palate as the primary supporting material was used a thin- profiled

mesh NiTi, the thickness of filaments is 40 micrometers with the cell size of 3x3-5x5 mm.

3 Operation Technology

Depending on the size and shape of the palate defect a refreshing incision was performed in some distance from its edges 0.5-1.5 cm towards the palate mucosa. For big and round defects such incision was performed by taking into account the dissection of one adequate mucosal-periosteal flap based on the defect size on not injured palate area. Starting from the line of cuts was performed the detachment of muco-periosteal flap, which was then rotated by 180 degrees and then continued as far as possible in the direction of the nasal surface. The edges of the detached flap were exposed to epithelization at a distance allowing it to freely come into contact with the tissues of newly formed bed of the nasal surface of palate and after placing it in the defect area there was performed its adaptation with the tissues of the maternal bed by the interrupted vicryl sutures. Over the deployed flap a mesh NiTi (nickelid titanium) was placed so that the edges were easy to introduce into a bed created for them. The excess of material was cut and removed using surgical scissors. The material due to the effect of wettability was instantly immersed in the tissue and blood mass. Further, the operation was complete by closing of the wound surface by the previously made soft protective plate covered with antiseptic.

4 Results

The results of monitoring of all operated patients showed that the absolute majority of our patients had good results, which were expressed in the primary wound healing and in the complete elimination of existing defects in the palate. Visual observation of the operating wound showed that in areas where a mesh NiTi (nickelid titanium) was placed, starting from the second or the third day of observation was noted the regeneration of the mucous by type of covering from the periphery to the center, which completed the formation of high-grade layer of mucous -periosteal cover over the implant material within 7-10 days. In any case, we have not identified any complications. In all monitoring cases the defects have been eliminated completely. For the developed method we obtained author's certificate and patent for invention numbered TJ 765 from 06/13/16 from the Patent Office of the Republic of Tajikistan.

An example from clinical practice: Patient M. 19 years old. Diagnosis: Palate defect as a result of a gunshot wound (Fig. 1).



Fig. 1. The defect of the palate as a result of a gunshot wound

The landmarks of lines for cuts were applied with highlighting a big-scale flap on one side of the palate. The operation was carried out by using our method (Fig. 2 – 5).



Fig. 2. A detached big -scale flap is rotated by 180 degrees and placed in the defect area.

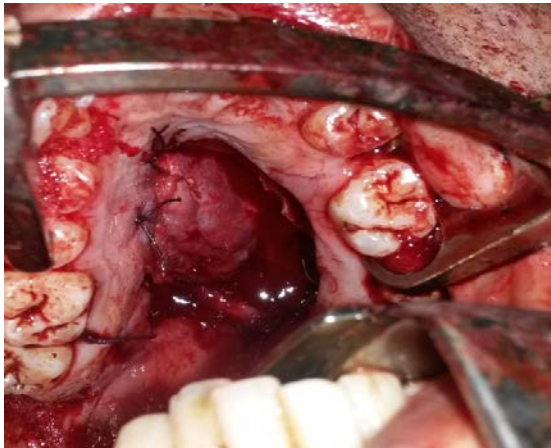


Fig. 3. De-epithelized edges of the palatal flap introduced in the formed bed and adapted by vicryl sutures.



Fig. 4. The stage of placing a mesh NiTi on the wound surface.



Fig. 5. Regeneration of palate tissues by type of covering a mucous cover from the periphery to the center. The 4th day of observation. It is seen that the half of the implant is covered with mucous- periosteal cover.

5 Conclusion

Application of a thin- profiled mesh NiTi (nickelid titanium) with filaments' thickness of 40 micrometer sand with the cell size of 3x3-5x5 mm for patients allows to improve the quality of the surgical technique in conducting surgical procedures for eliminating different forms and sizes of the palate defects. Due to its biochemical, biophysical compatibility with the body tissues and the peculiar integration properties a connective tissue grows around and through the structure of the implant by forming a durable frame. At the same time this process takes place by type of covering the muco-periosteal cover from the wound periphery to the center of the palate, over the implant material and completes with the full elimination of the existing defect. Application of a mesh NiTi is particularly prescribed for the elimination of big-scale palate defects when there is a significant lack of its tissues, as well as there is a risk of inconsistency of sutures. The developed method should be considered as minimally invasive surgical

techniques and is recommended as a method of choice for patients with various background diseases.

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References

- [1] P.Z. Arzhantsev., S.A. Isakov, Eliminating residual defects of the palate after uranoplasty, Congenital pathology of temporomandibular joint [in Russian]. M., 1989
- [2] G.V. Gonchakov, A.G. Prityko, S.G. Gonchakova et al., Analysis of the results of treatment of patients with residual palate defects after uranoplasty, Proceedings of the VII international conference of maxillofacial surgeons and dentists [in Russian]. SPb., 2002, p.41.
- [3] A.A. Radkevich and others, Surgical treatment of patients with congenital cleft palate and postoperative palate defects with the use of TiNi implants [in Russian], MIC, Tomsk, 2008.
- [4] A.A. Mamedov, New approaches to the treatment of children with congenital cleft lip and palate in modern conditions of healthcare in Russia, Dental South, 9 (2008) 12-16.
- [5] V.A. Kozlov, S.S. Mushkovskaya, N.N. Safonov, Defects of hard palate after primary uranoplasty and methods of their elimination, Human, St. Petersburg, 2010.
- [6] G.V. Kruchinsky, A new way of eliminating the palate defects, *Ibid.* 14 (1971) P.22-27.
- [7] A.A. Radkevich, V.G. Galonsky, M.Y. Yushkov, Surgery of palate defects with using nickeline titanium tissue, Shape memory materials and new technologies in medicine [in Russian], MIC, Tomsk, 2006.
- [8] M.Y. Yushkov, Surgery of palate defects with using shape memory materials, Abstract of dissertation for obtaining the Ph.D. degree in Medical Sciences, Irkutsk, 2008.
- [9] K. H. Gundlach, C. Maus, Epidemiology and frequency of clefts in Europe and around the world. Epidemiological Studies on the frequency of clefts in Europe and World – Wide, Maxillofac. Surg. 34 (2006) 1-2.