

# MEDICAL NAVIGATION AS A METHOD OF PRECLINICAL INVESTIGATION OPTIMIZATION IN ORAL OSTEOPLASTIC SURGICAL INTERVENTION

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## Introduction

The main task of the practical surgeon during implantation is to restore the lost structure of the jaw alveolar bone. In our opinion, researcher has a somewhat different task: to find alternative methods of diagnostics and treatment that would prevent the manifestation of inflammatory and degenerative processes in the tissues as a result of surgery. Literature data shows that in many cases surgical trauma on the first and second stages of implantation leads to loss of bone tissue. We consider that the use of the interactive methods is the best ways to prevent it. Therefore, the goal of our study is the assessment of the efficiency of medical navigation method in preclinical research for maximum preservation of patient bone tissue.

## Materials and methods.

We have carried out the experimental surgery dental implantation (during 6 month observation) with the registration of physical factor influence on the periosteum in the implant region. We have used the phantom implants (similar to real: D = 3.5mm; L = 10.0 mm). We have supposed that the surgical operation is a destroying pathogenic factor and leads to uncontrolled pressure (traumatic stimulus) on the periosteum.

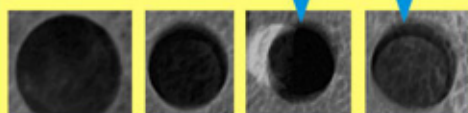
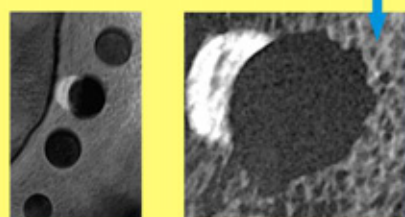
To control the implant moving and positioning, we used our own method on the base of device "Navigator YK" (Ukraine Patent № 68641). The device receiver is fixed rigidly on the bone segment. Position appliance was integrated with the tip, transition was fixed on conventional implant point. The calibration carried out with the help of micrometer GTC-A-650 (Mitutoyo, Japan), the measurement accuracy was 0.001 mm. A standard operational protocol was developed.

Dynamic pressure on the periosteum also determined according to a technique using a silicon tensoresistor, which was fixed on a conical titanium plate, placed on the dorsum of the implant (Patent of Ukraine № 75649 and 73268). Deformation of bone tissue was determined using inductive displacement meter, developed by the Geotechnical Mechanics Institute of the Ukraine Academy of Sciences.

In the absence of medical navigation device, as the signal to stop rooting dental implant operation during his latest revs, considered compression to a thickness of 0.5 mm of homogenous bone layer placed on the back of the platform implant.



The pilot unit



Example result Rx control laboratory experiments



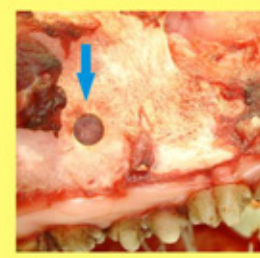
Autogenous bone material



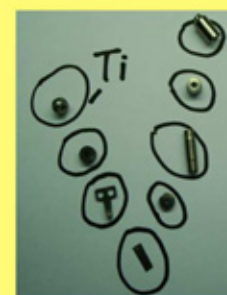
Synthetic bone material



Laboratory animal medicine



Example of laboratory research techniques implantation



Laboratory investigated samples implants

PS  
↓ Identified defects anatomical structures

## Results.

Precision of the implant angular positioning with deviation of less than 25 and more than 5 angular minutes is about 10% and increases to 20% with smallest deviation, less than 5 angular minutes. It was determined that the implant pressure on the bone tissue grew disproportionately with the same rotatory force and became destructive at some value. Since our aim was to completely eliminate pathogenic factors, we have not determined the minimal pathogenic values in different areas. In 20% of cases we observed a continuing bone layer deformation for 3-5 minutes after mechanical load removing.

It caused the nonuniform bone structures deformation. The bone layer about 1 mm thickness diminished to 0.5 mm at last implant turns and tightens gap between the periosteum and the implant platform. Further movement of the implant was destructive.

## Conclusion

The proposed approach optimizes the process of surgery and recommended for clinical usage in order to preserve alveolar ridge and the most favorable conditions for the realization of their own osteogenic potential.