

## BISPHOSPHONATES' IMPLEMENTATION IN TRAUMA MANAGEMENT: A METHOD OF BONE HEALING FACILITATION

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**Abstract.** *This article is dedicated to the brief overview of bone healing in current clinical practice. Modern ways of bone healing stimulation are still expensive and could be performed only in hospitals. Due to that, their effectiveness is restricted. The goal of the research is to prove that bisphosphonates, which are widely used in rheumatology, may be useful for bone healing via suppression of osteoclastic bone resorption. In the end of the research, it is stated that bisphosphonates' implementation elevates the quality of bone healing, according to laboratory tests' results and the final clinical picture.*

**Keywords:** *bisphosphonates, bone healing, fracture, nonunion.*

This issue seems acute as despite new achievements in surgical technique and implementation of new implants for bone and joint surgery, the percentage of nonunion remains high. The association between bone healing and environmental factors, sedentary lifestyle, imbalanced diet is well established and has been demonstrated in a number of previous studies [1, 2]. As a result, new methods of bone healing both surgical and pharmacological are necessary to improve the current situation [2, 3]. At the present time there are several ways for bone healing facilitation: active forms of Calcium with Ergocalciferol, Platelet-rich blood plasma (PRP), ultrasonic shockwave therapy and many others [3, 4, 5]. Every method has its own advantages alongside with disadvantages. The application of bisphosphonates (BP) for bone healing has not been completely examined in clinical practice yet. On the other hand, the biological activity of bisphosphonates is well established and fairly predictable which is particularly significant for prognosis and management of the adverse effects [6, 7]. Experimental researches of BP application for bone healing, performed on animal models, revealed positive clinical results of fracture closure [7].

The objective of the research is to analyse the experimental practice of BP implementation for bone healing facilitation.

**Materials and methods.** The design of the research is prospective, non-randomized, controlled study. All participants were the patients of both sexes who had undergone surgical treatment at the Orthopedic Departments in the city of Voronezh. The age of the patients was from 21 to 40. All the patients signed informed consent before the beginning of the research. The patients were divided in two groups: group I (case) which consisted of the patients receiving BP therapy and group II (control) which consisted of the patients receiving non-BP therapy. Patients of both groups during bone healing process were given Calcemine, a calcium containing drug, in standard dose. The patients of group I were given Alendronic acid in tablets alongside with Calcemine. The blood samples were taken from patients for bone resorption markers: Osteocalcine (OC) and beta-Crosslaps (bCL). The timing for blood sample taking was similar for all the patients for both groups: on day 1 after surgery, a month after surgery and in 3 months after surgery. Meanwhile, patients were asked about compliance and possible adverse effects during all the time of the Research. At the final point all the data has been statistically processed and conclusions were made.

**Results.** The initial blood sample in both groups had similar results: the blood level of OC and bCL was virtually identical. The level

of OC  $21,2 \pm 1,2$  ng/ml in core group and  $20,3 \pm 0,9$  ng/ml in the control one. For bCL the results were  $0,71 \pm 0,15$  ng/l and  $0,68 \pm 0,16$  ng/l respectively. In-group differences were statistically not significant ( $p > 0,05$ ). In a month differences started to differ: the level of OC in core and control groups:  $30,11 \pm 1,2$  ng/ml and  $24,14 \pm 1,1$  ng/ml. The level of bCL was:  $0,78 \pm 0,08$  ng/l and  $0,88 \pm 0,05$  respectively. In-groups differences were statistically significant ( $p < 0,05$ ). In three months results were: OC in core and control groups:  $27,2 \pm 2,2$  ng/ml and  $21,3 \pm 1,8$  ng/ml. The level of bCL was:  $0,525 \pm 0,07$  ng/l and  $0,619 \pm 0,05$  ng/l respectively. In-groups differences were statistically significant ( $p < 0,05$ ). The level of OC became higher, what can be explained because of increased bone formation via osteoblastic hyperfunction. Vice versa, the level of bCL became lower because of osteoblastic suppression, especially in core group. The higher level of OC and lower level of bCL may be explained with pharmacological effect of Alendronic acid- suppression of bone resorption via osteoclastic apoptosis.

When estimating final results, in control group 4 cases of delayed bone healing were recorded. On the other hand, the core group had no cases of delayed healing. So our team

has made a conclusion that elevating of bone healing results could be achieved via moderate suppression of bone resorption. After the Research it may be stated, that the normalization of bone healing can be achieved with bisphosphonates, especially Alendronic acid. During three months of investigation, it was stated that in core group the level of osteocalcin was higher, but the level of beta-Crosslaps was lower, which can be a symptom of better growth process in bone tissue. When examining final results, there were no cases of delayed bone healing in core group. So to say, the implementation of Alendronic acid for bone healing may be a good idea to achieve better results in general. However, good trauma management on previous stages remains crucial in all cases.

**Conclusion.** According to the obtained results, BP admission appears as the effective way of bone healing promotion. Clinical safety of these drugs, which has been approved in rheumatology, poses a possibility of their implementation in Traumatology and Orthopedics. Suppression of osteoclastic apoptosis leads to less bone turnover what accelerates bone healing then. The implementation of BP in different clinical cases, however, remains a topic of further investigations.

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## ПРИМЕНЕНИЕ БИСФОСФОНАТОВ ДЛЯ ЛЕЧЕНИЯ ТРАВМ: МЕТОД ПОВЫШЕНИЯ КАЧЕСТВА ЗАЖИВЛЕНИЯ КОСТЕЙ

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***Аннотация.** В статье дается краткий обзор заживления костей в современной клинической практике. Современные способы стимуляции заживления костей все еще дороги и могут быть выполнены только в больницах. В связи с этим их эффективность ограничена. Цель исследования - доказать, что бисфосфонаты, которые широко используются в ревматологии, могут быть полезны для заживления костей путем подавления остеокластической резорбции кости. В ходе исследования утверждается, что применение бисфосфонатов повышает качество заживления костей в соответствии с результатами лабораторных испытаний и окончательной клинической картиной.*

***Ключевые слова:** бисфосфонаты, заживление кости, перелом, несрачивание.*