

Elasticity Behaviour of a Healthy and Osteoarthritic Human Knee's Fresh Cancellous Bone

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ABSTRACT

The aim of this paper is to evaluate the elasticity modulus of fresh human cancellous bone from the internal and external compartments segments of osteoarthritic and non-osteoarthritic knees. Cancellous bone samples of young and old subjects from both genders were collected. The measurements of the elasticity modulus were made only few hours after the samples were taken in through compression tests. The results show that the average value of elasticity modulus of the internal compartment (IC) (84.92 MPa) was the double of the external one (EC) (40.12 MPa). These values were found regardless of the gender and age factors. In osteoarthritic knees only the values of the internal compartment (121.88 MPa) increased, without significant variation of those of the external compartment (42.91 MPa). The results of this work need to be confirmed by other series. If they are validated, they would explain that the preferential site of osteoarthritis on the inner compartment of the knees is not only due to a static disorder, but that there is a structural bone factor. The confirmation of this new parameter will invite us to a review our anatomical, physiological, biomechanical knowledge of cancellous bone. The study was approved by the ethics Committee of Rabta Tunis Hospital, and all participants provided informed consent indicating their conscious and voluntary participation.

Introduction:

In recent years, osteoarthritis has been the subject of numerous researches because of its social and economic repercussions [1]. The results of these researches are most often contradictory and make it impossible to understand either loads of observations such as the heterogeneity of the articular localizations, or the weak correlation between the radiographic changes and the clinical symptoms. That's the major purpose of this work; it's beginning on the internal compartment of the knees and not on the external one. We propose to know whether the preferential site of knee osteoarthritis on the internal compartment of the knees is determined by the various deviations of the knees [2], or if a bone parameter is associated with it, as the work of Martens et al. [3] seems to suggest. To approach this work, we chose to study among the large numbers of biomechanical parameters allowing characterizing the mechanical behaviour of the bone [4].

The most demonstrative parameter is the elasticity modulus. This module represents the relationship between a load applied to the section of a bone structure and the displacement induced in response to this load. If the values of the elasticity modulus of the materials are well known, we cannot say that about the bones.

Conclusion: In this work, the study of compression tests of the knee's cancellous bone shows many peculiarities. The overall results of the elasticity modulus found are different from those published [8]. Does this difference lie in the choice to work on fresh and unsecured cancellous bone? This bone has anisotropic properties according to the anatomical location of the internal or external compartment of the knee joint. For the external compartment, it is 37.28 MPa for men and 41.61 MPa for women. For the internal compartment it is 84.34 MPa for men and 84.81 MPa for women. What's the cause that can explain the greater female frequency of osteoarthritis? In the osteoarthritic knees, only the values of the elasticity modules of the internal compartments are increased. It is noted that osteoarthritis occurs more frequently in single women. These results, if validated by other studies, would allow us to reconsider our reading and teaching of anatomy in general and of the musculoskeletal system in particular, and thus answer the repeated calls of many teams, [6,11-26] to better understand and treat a variety or multitude of orthopedic pathologies?

Keywords:

Fresh cancellous bone; Knee; Elasticity modulus; Osteoarthritis, Decadent bones and joints