

MP Joint of the Thumb — Thickness of the Subchondral Zone of Mineralization and Subchondral Bone Density

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75 anatomic preparations of the MP joint of the thumb were studied by means of computed tomography-osteosorptionmetry (CT-OAM). The results reveal the predominance of the polymorph type (type A) of distribution of the density maximums in caput ossis metacarpalis and the prevalence of type C (maximums are located mainly in the dorsal and/or radial area) in basis phalangis proximalis.

The results of the investigation of the thickness of the subchondral zone of mineralization of the histological slices of the anatomic preparations of the MP joint of the thumb prove the existence of three types of distribution of the maximums of this parameter: type A — polymorph type, type B — maximums are located mainly in the center and type C — maximums are located in the dorsal and/or radial area.

Key words: subchondral bone, density, thickness.

Introduction

The simultaneous investigation of two morphological parameters reflecting the long-term stress in the joint provides richer information concerning its mechanical situation.

The CT — OAM method can be applied to patients and the data collected can be used in the process of diagnosing of some mechanically predetermined joint diseases. The method by means of which the thickness of the subchondral zone of mineralization was defined was additional and controlling.

Material and Methods

1. Determination of the thickness of the subchondral zone of mineralization 4 anatomic preparations were put in methylmetakrylat (MMA) and anatomic slices were made — 100 μm in thickness. By means of Vidas — an image analyzing system — the thickness of the subchondral zone of mineralization was determined — this process was carried out perpendicularly to the joint surface. The values achieved were used for creating images — aggregates of isocrasides (Fig. 1). The isocrasides are lines that connect points with the same thickness.

Schemes were made based on these images showing the location of the highest values of the parameter studied.

2. Determination of the subchondral bone density by means of the CT-OAM [1, 2, 3, 4, 5].

75 anatomic preparations of the MP joint of the thumb were investigated. By means of the computer tomograph (Picker) CT-slices were prepared 1 mm in thickness each. Afterwards the slices were digitalized with the computer program Analyse®. The purpose of the computer processing was to achieve colour image of the different layers of subchondral bone density (Fig. 6). In this way the distribution of the subchondral bone density was determined for both joint surfaces — caput ossis metacarpalis and basis phalangis proximalis. For better interpretation of the results schemes were drawn based on the colour images. These schemes show the location of the areas with highest bone density.

Results and Discussion

The results from the investigation of the subchondral zone of mineralization prove the existence of three types of distribution of the maximums of this parameter.

Type A — polymorph (Fig. 2)

Type B — maximum located mainly in the center (Fig. 3)

Type C — maximums located in the dorsal and/or radial area (Fig. 4)

The results of the investigation of the distribution of the subchondral bone density reveal the following types of distribution:

Type A — polymorph type (Fig. 2)

Type B — maximum located mainly in the center (Fig. 3)

Type C — maximums located mainly in the dorsal and/or radial area (Fig. 4)

Type D — maximums located mainly in the palmar area (Fig. 5).

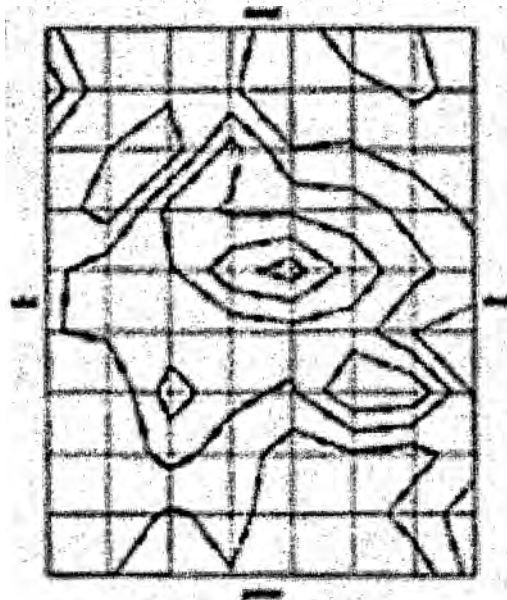


Fig. 1. Isocrasides

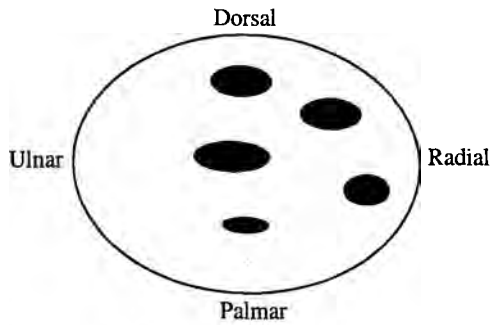


Fig. 2. Type A — polymorph

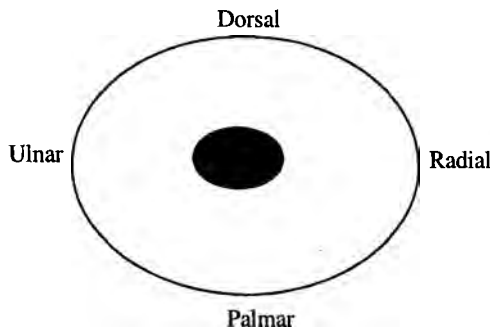


Fig. 3. Type B — maximum located mainly in the center

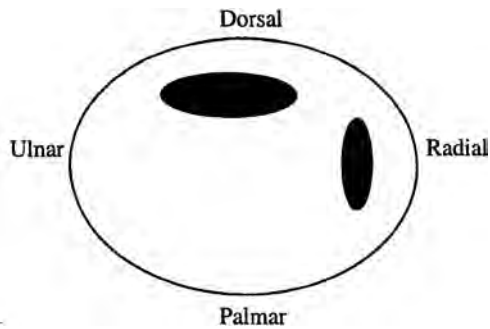


Fig. 4. Type C — maximums located in the dorsal and/or radial area

Caput ossis metacarpalis — it was concluded that the polymorph type of distribution of the density maximums is prevailing.

Basis phalangis proximalis — the results show that the maximums are mainly located in the dorsal and/or radial area of the joint surface.

These results illustrate the way of adapting of the joint surfaces to the long-term stresses.

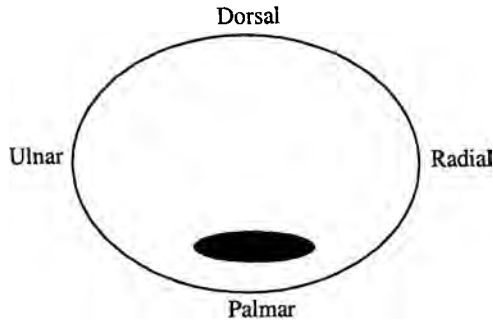


Fig. 5. Type D — maximums located mainly in the palmar area

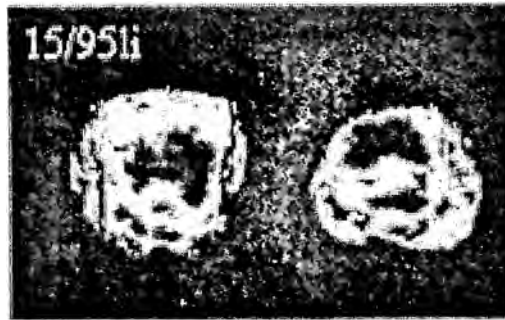


Fig. 6. Determination of the subchondral bone density by means of the CT-OAM

We suggest that the necessity for quick transition and combination of movements has been the leading factor in the formation of the models of distribution of the thickness of the subchondral zone of mineralization and bone density.

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