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MORPHOLOGICAL STUDY OF DISTAL RADIOULNAR, RADIOCARPAL AND MEDIOCARPAL JOINTS ON CADAVER MATERIAL FROM ELDERLY PEOPLE. II. ARTICULAR CARTILAGINES AND *DISCUS ARTICULARIS*

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ABSTRACT

Wrist joints are a complex system whose functioning depends on a number of factors. The most significant of them are the status/condition of *discus articularis* and the cartilages covering joint surfaces. This study on cadaver hands of elderly people (60 years old and over) covered the changes in joint cartilages and *discus articularis* and the role of these changes for the functional discomfort of wrist joints. The condition of the joints mentioned above has been observed with a magnifying glass (3x) in twelve cadaver hands. Material for light microscope observation was taken from representative parts of *discus articularis*. The scopic investigation revealed erosions on the surface of the radiocarpal and mediocarpal joints cartilage. Such erosions were observed in two cases (16,67%) in radiocarpal joint and in 5 cases (41,67%) in mediocarpal joint. The microscopic observation showed indentations and fissures on the *discus articularis* surface, some of which filled with residual material. Some erosions have grown into fissures penetrating deeper. A decrease in the number of chondrocytes in *discus articularis* has been detected together with homogenization of extracellular matrix especially in their deeper layers. In the closest proximity with the cartilage surface, isogenous groups with a decreased number of chondrocytes were found out. Degenerative changes were established in chondrocytes, vacuoles being formed at the site of the dead chondrocytes. The extracellular halo substituted the fibrilated territorial matrix. A decreased cell number was observed in the overall structure of *discus articularis*. These changes in the structure of joint cartilage and *discus articularis* due to age are brought up for a discussion as a cause of possible functional discomfort in wrist joints often accompanied by a vague pain syndrome.

Key words: wrist joint, wrist bone, articular disc, articular cartilage, chondrocytes, histology

INTRODUCTION

The wrist joint complex is a complicated system. Its function depends on a number of factors, the most essential being the status of the cartilage covering the articulating surfaces of the wrist bones and the articular fossa at the distal end of the radius (*facies articularis carpi*), as well as on the status of the cartilage forming *discus articularis*. The structural changes in the cartilage can be provoked by a series of factors.

Scientific data shows that in younger age mainly frequent trauma of this complicated articular complex occur, while with ageing degenerative changes appear in the structure of the cartilage tissue forming the articular disk and covering the joint surfaces.

In an earlier study it was demonstrated that changes in articular cartilage may likewise develop against the background of variations in the pattern of joint surfaces (2). It is not clear, however, how these changes correlate with age alterations of the cartilage tissue of this complicated joint system.

Proceeding from the aforementioned prerequisites, we made it our aim to study the state of *discus articularis* and of the wrist articular cartilage of the wrist joint complex using cadaveric material from elderly individuals (over 60 years).

The study of these issues has a direct effect in clarifying their role in the development of the often met functional discomfort in the wrist joints after 60 years of age accompanied by pain syndrome (4,5,8).

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MATERIAL AND METHODS

lection of articular material

velve upper extremities from the cadaver bank of the Dertment of Anatomy, Histology and Embryology at the edical University of Varna were used in the study. As a nciple, the cadaver material is from elderly individuals ver 60 years). Only few preparations from younger indiluals can be found.

ssection of articular material

soft tissues located around external fibrous layer of the it capsule of distal radioulnar, radiocarpal and diocarpal joints were carefully removed. The joint cavi- of these joints were opened by cutting the both sheaths he articular capsule with mainly palmar dissection at the el of *articulationes radioulnaris distalis et radiocarpalis* mainly dorsal dissection at the level of *articulatio liocarpalis.*

roscopic study of articular material

surface of *discus articularis* and articular cartilage covg the wrist bones were studied macroscopically by carenspection under magnification (3x) and with descripof:

Discus articularis

A. Size
B. Presence of erosions
C. Presence of foramina

Articular cartilage

A. Presence of papillomatous proliferations
B. Presence of erosions
C. Location of erosions

microscopy

bles from *discus articularis* were carefully dissected ixed in 10% buffered neutral formalinl for a period of ays and after that were carefully washed, soaked and dded in paraffin using a routine procedure. Paraffin otom sections thick 5μm were prepared and stained hematoxylin eosin and orcein using routine ogical technique.

ections were examined and photographically docud light-microscopically with Zetopan-Reichert mipe.

RESULTS AND DISCUSSION

oscopic study of articulatio radiocarpalis

scus articularis

e of the twelve disks under study the following variarom the norm were established: small-sized disk failcover completely the head of the ulna (one), disk with l opening (one) and disk exhibiting visible necrotic s (one) (Table 1).

2. Articular cartilage

Articular cartilage erosions were established in two cases (16,67%): one involving *radius, os scaphoideum* and *os lunatum*, and *one - os triquetrum* (Table 1).

Table 1. Changes in articulaciones radioulnaris distalis et radiocarpalis

No.	Changes in *discus articularis*	Erosions on joint surfaces
1.	-	-
2.	-	-
3.	+ (< *ulna*)	-
4.	-	-
5.	-	+ (*os triquetrum*)
6.	+ (small opening)	-
7.	-	-
8.	-	-
9.	-	-
10.	-	-
11.	-	-
12.	+ (necrosis)	+ (*radius, os scaphoideum* and *os lunatum*)

Macroscopic study of articulatio mediocarpalis

1. Articular cartilages

Articular cartilage erosions were observed in five instances (41,67%). They were located as follows: in one case on the surface of *os lunatum* and *os hamatum*, in one case only on *os hamatum*, and in one case only on *os triquetrum*. These erosions were accompanied by other macroscopically detectable changes, mainly with smooth or papillomatous hyperplasias of cartilage (Fig. 1, Table 2).

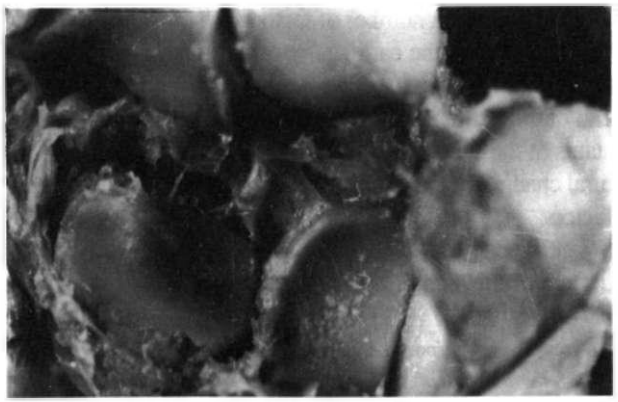

Fig. 1. Articulatio mediocarpalis. Erosions and papillomatous changes on the articular surface of îs lunatum and îs hamatum

Table 2. Changes in articulatio mediocarpalis

No.	Type of *os lunatum*	Erosions on the articular cartilage surface	Other changes
1.	II	-	-
2.	II	-	-
3.	I	-	-
4.	II	+ (*os lunatum* and *os hamatum*)	+ (papillomatous changes over the erosions of *os lunatum* and *os hamatum*)
5.	II	-	-
6.	II	+ (*os hamatum*)	+ (node of articular cartilage of *os capitatum*)
7.	I	+ (*os triquetrum*)	-
8.	II	-	-
9.	II	-	-
10.	I	-	-
11.	II	+ (*os capitatum*)	+ (styloid formation of *os capitatum*)
12	II	+ (heavily eroded surfaces of all articular cartilage)	+ (heavily eroded surfaces of all articular cartilage)

Light-microscopic study of discus articularis

The surface of *discus articularis* is uneven because of erosions of different size and depth that extend into deeply penetrating fissures with uneven contours. In the intact surface areas of cartilage the extracellular matrix is thickened and acquires fibrillar structure. Isogenic cellular groups made up of 3-4 cells are located in the immediate vicinity to the surface of *discus articularis*.

The chondrocytes are mostly ovoid but some isogenic groups may contain chondrocytes of lengthened shape. Most chondrocytes disclose signs of degeneration such as pycnotic nucleus filled with dark homogeneous material, scarce cytoplasm hardly detectable in certain cases. In part of the nuclei heterochromatin is disposed in a peripheral band pattern. The erosions and fissures contain detrite material made of remnants of chondrocytes and extracellular matrix (Fig. 2).

In the deep layers single isogenic groups of 1-2 chondrocytes are encountered, some of which present with degenerative changes. Vacuoles are formed at the site of degenerated chondrocytes. The presence of pericellular halo replacing the territorial matrix is noted. The intercellular matrix exhibits fibrillar elements and clear-cut predominance compared to cellular elements in all *discus articularis* areas.

Age related changes in the structure of wrist joints have been intensively studied. The present work examined cadaver material for age-related changes in *discus articularis* and in cartilage covering wrist joints occurring after 60 years of age. The macroscopic study of *discus articularis* reveals visible changes in three of the twelve joints under examination.

In one case severe necrotic changes are established on disk accompanied by markedly expressed erosions on the surface of articular cartilage. In another case disk with small opening is seen which accounted for the communication existing between distal radioulnar and radiocarpal joints, a communication usually absent. Based on the data available alone it is difficult to judge whether or not it is a matter of anatomical variants described in publications, or otherwise a matter of acquired posttraumatic lesion to cartilage (6,7,9). In this case the erosions on the cartilage of *os lunatum* and the degenerative changes in ulnar carpal bones were absent (9). Once a small-sized disk was observed failing to provide complete coverage of the ulnar head. The

Fig. 2. Discus articularis. Deeply positioned fissure with uneven contours. Fibrillar intercellular matrix. Isogenic group with degenerative changes in chondrocytes. Histological section stained with hematoxylin-eosin. Microphoto: oc. 10x; ob. 40x.

unctional implication of this particular phenomenon hardly ends itself to interpretation.

he macroscopic study of the articular cartilage reveals eroons in *articulatio radiocarpalis* along the articular surces in 2 cases (16,67%), in one case on *radius, os caphoideum* and *os lunatum* and in the other on *os iquetrum*. The macroscopic study of articular cartilage of ticulatio mediocarpalis shows erosions along the articur surfaces in 5 instances (41,67%) located on the surface os lunatum, os hamatum and os triquetrum. These eroons are accompanied by other macroscopically detectable anges in cartilage, mainly smooth and papillomatous hyrtrophy of cartilage. From a clinical point of view this enomenon is worth attention because publications men- in that *os lunatum* type II may be associated with substan- l erosions on cartilage of the proximal pole of *os matum* (3,11) which cannot be visualized by x-ray but by hroscopy (11). Such erosions have been established dur- the present study, too, and on the medial facet of the ate bone. Presumably, they may give rise to the vague n complaints in the ulnar aspect of the wrist (3,11).

e analysis of results shows that articular cartilage of diocarpal joint is comparatively more often affected by sions than that of radiocarpal joint. The light microscope dy of *discus articularis* shows that after the 60th year of it undergoes significant degenerative changes. They are ressed by erosions and fissures of different diameter and th containing detrite material, decreased number of ndrocytes, atypically situated isogenic groups (on the ace) of 3-4 chondrocytes, signs of chondrocyte degenion on the surface and in deeper located isogenic ups, vacuoles replacing the dead chondrocytes, forma- of pericellular halo substituting the territorial matrix, e fibrillar elements in extracellular matrix. Cartilage reunization, reduced cellularity, fibrillation, changes in ndrocytes and intercellular matrix are characteristic fea- s of osteoarthrosis (10), which undoubtedly lead to alions in the biomechanical properties of *discus ularis*. This structure responds in a different manner to pression applied under normal conditions compared to rticular cartilage due to its difference in rigidity which eferred to as 'compliance' in the literature. The age-related and osteoarthritic changes described above most likely affect the compliance of *discus articularis* which depends on time and the stress deformation of material. As a result, the alterations in the biomechanical properties undoubtedly lead to alterations in the ulnar carpus function and are likely to account for the ulnar wrist pain described in the literature felt mainly during forearm rotation (1).

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