MORPHOLOGICAL AND BIOMECHANICAL CORRELATION IN THE 'TENNIS ELBOW'.

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INTRODUCTION

In the field of the sports pathologies, due to the functional of the muscolaris and osteo-tendinous structures, "tennis elbow" is, of course, one of the most diffuses .

In a Peterson et al. study result that the 45% of subjects that play tennis daily and the 25% of subjects that play tennis at least twice a wear, are suffering from tennis elbow. The above mentioned pathology is common in other sportive discipline (golf, fencing, baseball etc.) and in all that working activity pledging recurrently prone-supination movement of the forearm with hand prenensile posture. The purpose of our study is to investigate, in the field of the tennis elbow's biomechanic aspects, the entity of the muscularis group of elbow and wrist articulation putting in correlation tthe results to a morphological study of the insertional pathology.

ANATOMY AND BIOMECHANICS

The insertion of extensor of wrist muscles is proximal to the lateral epicondyle of the humerus with a single aponeurosis. These muscles that are included on the humerus are: brachioradial, long and short radial extensor of wrist followed by other extensor muscles. Tendon of the short radial extensor of wrist forms the predominant part of the common extensor tendon.

Long radial extensor of wrist and brachioradial muscles don't have part in the formation of tendon. With the foream in completly prone position and elbow extended, the orientation of the short radial extensor of wrist cause a stretching of this muscles on the hard of radius. This fulcrum function trained by head of radiu caput radials increase the force tension transmitted to the proximal insertion of this muscle, when it's stretched during drop wrist, together with foream pronation and elbow exension. This can in part explain the sensitiveness of this tendon to chronic imlammation in the insertion or close to it. This factor is important for clinic point of view because the short radial extensor tendon is the most frequently interested in the tennis elbow cases. The articulation of the elbow is an unfavourable fulcrum system (the lateral epicndyke medially inclined create a fulcrum for the prominent head of radius). To aggravate the situation adjoin a force overload. The overloads can be intrinsics (sudden active idiomuscular contraction) and extrinsics (extern forces, stretchings).

In the district of lateral epycondilis of humerus, besides insertion of radial extensor of wrist muscles by means of common extensor tendon. partially insert supinator muscle that bringt the foreamrm in supination position. The radial extensor muscles act usually in synergism i the flexor of the fingers mm. simultaneously contract whit. The radial extensor maintaining teh wrist in extention and obtaining a more strong graps ("hand-shake"). This stabilizing action of extensor of wrist become necessary in all the situations in wich is necessary that superior member has to be unit with the tool; like in strainghthand and in backhand stroke, where the racket is in a position to transit to it the energy gave from the trunk muscles and shoulder girdle (cingulum) at the moment of striking the ball. In the execution (performance) of the set the extensor of wrist mm. behave like a catapult spring assuring loading and acceleration phase of the atheltic action.

DEFINITION AND PATHOGENESIS

"Tennis elbow" is an acute or chronic insertional tendinous disease with a phlogistic-degenerative pattern of osteo-tendinous junction of extensor of wrist muscles.

The etiology of "tennis elbow" is multiple and sometimes it's difficult to identify it seeing interactions complexity between specific technician gesture and sporting and sporting tool. All the causes that been suggested are: bursitis, incarceration of radial nerve branca, presence of an hyperaemic zone of synovial tissue of humeroradial articulation and compression of this tissue between the agad of radius and the capitulum, infection, periostitis, intrarticular anomalies, orbicular ligament inflammation, common extensor rents.

In agreement with other authors we think thata the "tennis elbow' is a syndrome caused by an excessive use of the articulation, an unable use of rackets, an uncorrectable execution of the athletic gesture and

above all it is caused by a difference in the force relations of the antagonistic muscular groups. Indeed every time that the ball strikes teh ropes of the rackets, occur more or less intense vibrations in relation to the frame material relative tension and type of tuning, balange between the head nad the handle of the racket; each vibration discharge on derivation of epicondylian muscles and the distortions of the collision waves, if they are favourite by a muscular hypotonia. transmit to the athlete's member some sollecitations and the adding in the course of time can support the pathology appearance; therefore, power, force and resistance of the musculo-tendinous structure, that extend the forearm, play a main roll, because it has to bear the force applied to the extensor aponeurosis (intrinsec overload).

In literature there aren't any standard guiding value of these parameters and above all of the power relation between the agonistic and antagonistic muscular groups pledged in the tennis athletic gesture.

PATIENTS AND METHODS

We studies 40 voluntereer subjects, with homogeneous characteristic antrhropometrials (TAB.1), aged between 35 and 43 (at this age this pathology is frequent) that paly tennis at least three times a wear. These subjects were divided in two groups; the first one, called 'tennis elbow', formed by subjects that in the last two years where suffering from one or more epicondylitis episodes and that before our valutation they taked up again in broad rythm the sportive activity four months before. The other one is a control groups that never suffered In the past from insertional pathology of the tested muscles all the subjects were submitted to a course of tests with an isokinetic ergometer (Lido Active. Loredan, CA-USA) to determine the peak torque (P.M.F.) in Newton-meters, the fatigue index in percentage of the maximum values of the first contractions. the total work developed (joules) and the agonistic/antagonistic ratio tested muscles.

The tests performed consider the followed muscular groups:

- flexors/extensors of elbow
- flexors/extensors of wrist
- radial and ulanr deviation muscles of wrist
- supinators/pronators of wrist

Each muscular group was studied by isokinetic dynamometer according to the followed prorocol:

- 5 maximum concentric contractions at the angular velocity of 90°/sec
- 10 " " " of 240°/sec
- 15 " " " of 360°/sec

N° subj.	ETA' age	ALT cm	PESO Kg	BMI	AFA cm2	AMA cm	AMC cm2
20 Tennis e.	38 +-6	174 +-5	70 +-8	23.1	72 +-2.2	55.2 +-3.1	26.3 +-2.8
20 control	36 +-4.5	171 +-4.6	73 +-5.6	22.9	7.1 +-3.8	55.3 +-3.7	27.00 +-4.3

TAB.1. Antrhopometrials characteristic- BMI= Body Mass Index; AFA= *Ann* fat area; AMA= *Ann* muscle area; AMC= Arm muscle circumference.

RESULTS

The normative data reported were obtained. for each muscular group of the dominant member (habitually pledged in the tennis practice), from the mean of the value of peak torque, fatigue index and total work developed at the three angular velocityes examined.

The expressive differences case-control were seen in the peak torque ratio (PTR) between the ext and flex of wrist, at teh angular velocity of 240°/sec (Fig.1); at the angular velocity of 360°/sec, pronatorslsupinators ratio of the groupe suffering from 'tennis elbow' was up to 138% compared with the 88% of the control group. At the angular velociiy the ext/flex ratio of wrist, of the 'tenni elbow" group, was up to 81% compared with the 50% of the control group. At the angular velocity of 90°/sec there wasn't any expressive differences between the two groups.

To know the junctional micro-environment in course of insertional pathology we conducted a morphological study at the myo-tendinous junction level of the two subjects affects by acute insertional pathology.

The biological material found during the operation was affixed in alcool-formolo (9:1 added with 1% di CPC a + °4). Subsequently, after dehydratation and infiltration with xylene, the fragments were included in paraffin and cut since 4 micron. The stainings performed were:haematoxylin eosin-floxine for the study of the cytologic characteristic, the trichromic T-OPA for the study of the extracellular matrix. The analys's of the

quantitative composition was performed by microscope polarizing, the sections were preprimed with red sirius for the evidentation of collagenicand proteoglycanic micro-fibrillar component.

We have seen how, at the myo-tendinus junction level the muscular component shows some unravelled tracts with visible modification of the microfibrillar component. Indee. this is dissolve in a matrix prevalently constituted by big bundles of collagen fibres that flow together. In particular, it's possible to note a considerable increase of tickness and packing. In the meshes of the collagenic net are distingishable, toaether with a litte pool of exudate without inflammatory contnuous capillaries together with pre-endothelial solid counters.

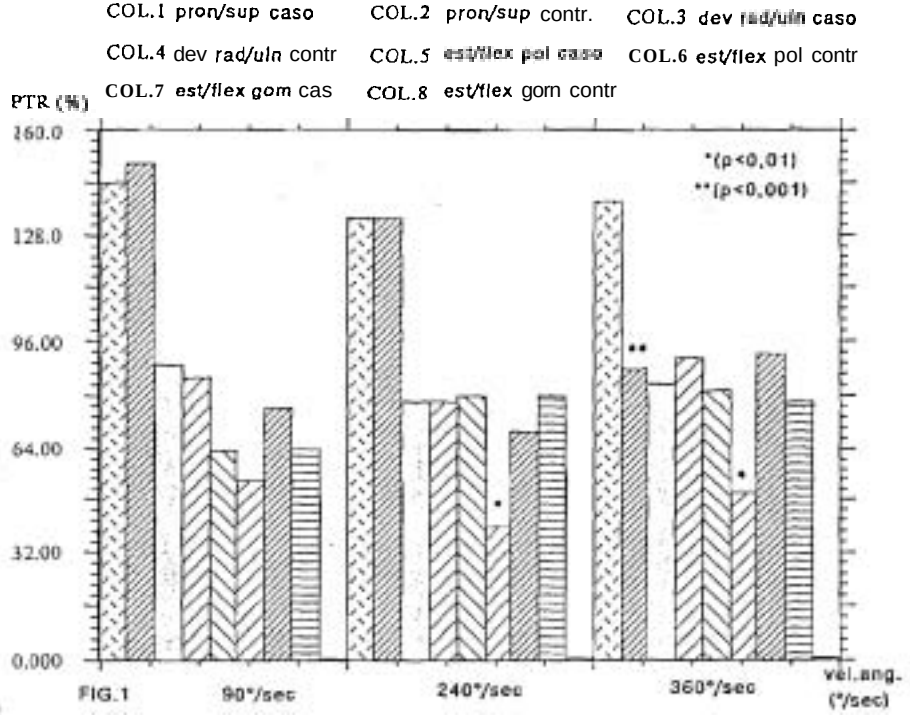

FIG.1

DISCUSSION AND CONCLUSIONS

The characteristics of the matrix seen at the microscope polarizing suggest how develope, in the myo-tendinous junction, an expressive reactive fibrosis presumably put in connexion with a precedent inflammation and put in evidence by the perifibrillar exudate pools. The variations of the found base structure (variation of tickness and packing), presumably recognize their origin in a changed assortement of the proteoglycan classes associated with collagen.

This "molecular metaplasia" is a characteristic epiphenomenon of the inflammatory process of the connective tissue.

The presence of a thick microvascular rete together with typical figures of the angiogenetic phase shows, together with the reactive fibrosis, the realization of a concomitant angiogenesis that can be evalvated like a subseguent and/or progressive stage of fibrosis.

In conclusion, the altered biomechanical charge, applied or developed at junctional level, above all due to an expressive disequilibrium of force between the two antagonist muscular groups, can be responsable of the intense structural modifications observed, characteristiced by rheological and viscoelastic modifications of the connectival matrix.

The modifications of this diffuse proteoglycanic matrix and the progressive loss of the viscoelasticity. determ the Injury observable in the nervous formations delegated to the periferial control of the myo-tendinous junction.

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