In the field of the sports pathologies, due to the functional of the musculotendinous 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 week, are suffering from tennis elbow. The above mentioned pathology is common in other sportive disciplines (golf, fencing, baseball etc.) and in all that working activity pledging recurrently pronosupination 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 musculotendinous group of elbow and wrist articulation putting in correlation the 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 forearm in completely 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 radius increase the force tension transmitted to the proximal insertion of this muscle, when it's stretched during drop wrist, together with forearm pronation and elbow extension. This can in part explain the sensitiveness of this tendon to chronic inflammation 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 epicondyle 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 epicondilis of humerus, besides insertion of radial extensor of wrist muscles by means of common extensor tendon, partially insert supinator muscle that bring the forearm in supination position. The radial extensor muscles act usually in synergism the flexor of the fingers mm. simultaneously contract whil. The radial extensor maintaining teh wrist in extention and obtaining a more strong grasp ("hand-shake"). This stabilizing action of extensor of wrist become necessary in all the situations in which is necessary that superior member has to be unitt 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 tendonious 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, incarcerartion 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 that 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 the ropes of the racket, occur more or less intense vibrations in relation to the frame material relative tension and type of tuning, balance between the head and the handle of the racket; each vibration discharge on derivation of epicondylial muscles and the distortions of the collision waves, if they are favourite by a muscular hypotonia, transmit to the athlete's member some solicitations 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 volunteer subjects, with homogeneous characteristic anthropometry (TAB.1), aged between 35 and 43 (at this age this pathology is frequent) that play tennis at least three times a week. 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 valuation 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 ulnar deviation muscles of wrist
- supinators/pronators of wrist

Each muscular group was studied by isokinetic dynamometer according to the followed protocol:
- 5 maximum concentric contractions at the angular velocity of 90°/sec
- 10° + - of 240°/sec
- 15° + - of 360°/sec

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<th>Nº subj</th>
<th>ETA' age cm</th>
<th>ALT cm</th>
<th>PESO Kg</th>
<th>BMI</th>
<th>AFA cm²</th>
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<td>38</td>
<td>174</td>
<td>70</td>
<td>23.1</td>
<td>72</td>
<td>55.2</td>
<td>26.3</td>
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<td>e+6</td>
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| 20     | 36          | 171    | 73      | 22.9 | 7.1     | 55.3   | 27.00   |
| control| +4.5        | +4.6   | +5.6    | +3.8 | +3.7    | +4.3   |

TAB.1. Anthropometrical characteristic-BMI= Body Mass Index, AFA= Arm fat area; AMA= Arm 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 velocieties 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, pronators-supinators ratio of the group suffering from 'tennis elbow' was up to 138% compared with the 88% of the control group. At the angular velociity 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 alcohol-formolo (5:1) added with 1% di CPC a +4%. Subsequently, after dehydration 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 analysis of the quantitative composition was sirus for the evidention of epicondylitis.

We have seen how, at the fragments with visible modifications, constituted by big bundles, considerable increase of collage togerher with a little pool of solid counters.
and the adding in resistance of the to bear the force all of the power relation

followed protocol:

Abbreviations (TAB.1), aged at least three times a wear. These caused by subjects that in the last before our validation they took was a control groups that never the subjects were submitted to a 1 to determine the peak torque values of the first contractions, muscles.

DISCUSSION AND CONCLUSIONS

The characteristics of the matrix seen at the microscope polarizing suggest how develop, in the myotendinous 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 evaluated like a subsequent 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 responsible of the intense structural modifications observed, characterized 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 periferal control of the myotendinous junction.
REFERENCES