



Presumable role of tennis in the evolution of listestic damage: focus on the technical gesture of the forehand in open stance in amateurs

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ABSTRACT

Although there is an individual style by virtue of which each athlete interprets the basic technical gesture by mediating it according to their own biomechanical characteristics, most tennis instructors suggest executing the forehand in open position or, borrowing the term from the English language, in open stance (shoulders parallel to the net) as there is a potential increase in ball speed. All, however, to the detriment of the integrity of the spinal tract, especially in genetically and anatomically predisposed subjects (Lisi, 2018). Without wanting to go into the merits of professional tennis, the Authors advise - in those who approach racket sport as an amateur without ambitions of excellence - the use of the traditional closed position (shoulders perpendicular to the net) or, at least, a semi-open stance as it is sufficient to limit any harmful consequences at the level of the spine and to maintain one's competitive performance (Lisi, 2018).

Key words: spine, forehand, open stance, closed stance, semi-open stance.

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INTRODUCTION

Spine is substantially made up of a sequence of bone segments connected to each other by ligament, capsular and tendon structures which make it, albeit in a different way in the various sections that compose it, mobile but stable in the healthy subject. In subjects who practice sports (specifically tennis players) they are required, in the context of a dynamic of a cybernetic nature, where the body learns and memorizes motor sequences, kinesthetic adaptations and continuously adapted to the instantaneous motor needs required by the gesture.

From this point of view, it is important that the athlete enjoys continuous monitoring by the medical-rehabilitation team. The maintenance of physiological curves, capable of following harmonic mobilization dynamics, integrated by the individual segments, will also serve to prevent the onset of symptoms that can also lead to total blockage of activity. The spine of young professional tennis players with no symptoms related to vertebral column pathologies was studied using magnetic resonance imaging. It emerged that only in 4% there were no pathological alterations of the spine (Rajeswaran et al., 2014).

These observations suggest that the stresses on the spine during the performance of tennis are extremely intense and make technical preparation an essential element of tennis practice proper (Lisi, 2018). During the execution of the basic strokes of tennis, the kinematics of the body segments has allowed to obtain important indications of practical utility



(Elliott, Baxter & Besier, 1999; Elliott, Takahashi & Noffal, 1997; Elliott, Overheu & Marsh, 1988; Kibler, 2004; Knudson, 1990). First of all, the fundamental role of internal rotation of the arm in the forehand was highlighted, significantly influencing its execution in both beginner and advanced level players.

Functionally, the rotator cuff muscles (particularly the joint action of the supraspinatus and subscapularis) must accelerate the upper limb to impact and continue their action before the antagonists contract eccentrically to decelerate the rotation in the follow-through phase (terminal phase of the technical gesture). The structural difference of the two muscle groups

(the internal rotators smaller than the external ones) requires a reconsideration of the specific training phases in order to avoid injuries or more or less disabling pathologies.

THE VARIOUS TYPES OF EXECUTION OF THE FOREHAND

The use of the open stance (Figure 1C), if it is not possible to adopt the traditional closed stance (Figure 1A) (shoulders perpendicular to the net) where a plastic evolution of a wider and slower movement is evident, does not allow adequate impulse generation at the trunk level and effective use of the lower limbs. This particular technical setting, in fact, by reducing the amplitude of the torsions of the trunk, places a limitation on the release of the force. The impossibility of performing rotations around the vertical axis reduces the ability to impose the right acceleration on the racket with an effective and balanced contribution from all body segments.

And this happens above all when the left lower limb (in a right-handed person), at the moment of loading the shot, is extended rather than bent and twisted. Again, although the movement of the body at the baseline is facilitated and the ball - from the frontal position - better visualized and perceived, the tennis player, "working only with the arm" as they say in tennis jargon, is required to accelerate the action of the limb dominant top to give the ball the classic forward rotation (top spin).

Among other things, the tennis player - who performs the forehand in an open stance (Figure 1C) - engages the lumbar spine in a right lateral inclination, which, although it is almost analogous to that shown in the tennis player in Figure 1A, requires a significantly right-hand rotation greater; in fact, in the tennis player in Figure 1A (closed stance), the right lateral portion of the lumbar spine and the right hemipelvis are already further back and therefore require a less demanding rotational movement for the capsule-ligament structures. It follows in our personal opinion that the tennis player in Figure 1C subjects the right vertebral hemiarch of the last lumbar vertebrae to a greater stressful insult on the isthmic area which, if frequently reiterated over time, could result in, among other things, a duration fracture (spondylolysis right isthmic) [Lisi, 2018].

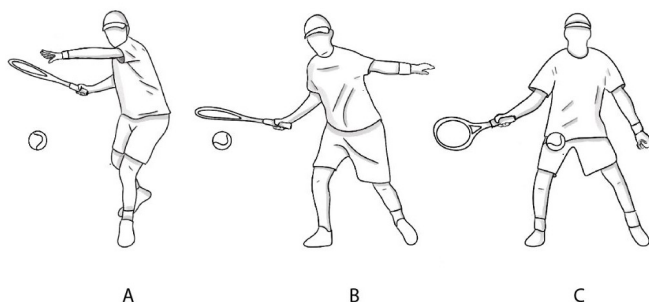


Figure 1. A. Closed stance; B. Semi-open stance; C. Open stance.

TENNIS AND SPONDYLOLYSIS

Spondylolysis, frequent in athletes, is the loss of continuity at the level of the isthmus between the upper and lower articular facet. Sometimes it evolves towards listhesis, affecting the practice of sporting activity.

The causes are varied and may have a genetic or mechanical root (associated with morphotypes with altered biomechanics from excess sacral tilt or scoliotic deviations), possibly associated, quite rarely, with subsequent traumatic events. Advancing age shows an additional cause in joint degeneration. Elective instrumental examination to detect the alteration is radiographic. CT and MRI are rarely needed to specify the anatomical picture.

Lysis is often detected as early as in the young, more often in males, due to the onset of pain: evolution in the pubertal period is high. In sportsmen and women, as we have said, it causes a slowdown or halt in the continuation of activity with the related consequences, especially in young competitive athletes, at the psychological level. In these cases, it is appropriate for the sportsman to be referred to a multidisciplinary team that can assess whether and how to continue training. This is particularly true in tennis, where the risk of progression of symptoms is higher due to the constant engagement of the spine.

TENNIS AND SPONDYLOLISTHESIS

Tennis, not unlike other sports, can be the underlying element of the symptomatology and possible listhesis. In addition to being supported by numerous researches on the incidence of spondylolisthesis in competitive and non-competitive sportsmen (Rossi, 1978; Hoshina, 1980; Ichinawa et al., 1982; Jackson, Wiltse & Cirinciole, 1976; Kotani et al., 1971; Kono, Hayashi & Naha-Hara, 1975) in support of the above assertion, the results of a study conducted by Takaaki Ikata, particularly prolific in dealing with issues relating to vertebral instability (Ikata et al., 1996). concluded that «[...] in an immature spine, the advanced stage of a defect of the interarticular portion is a risk factor for the onset of the often mentioned spondylolisthesis» (Ikata et al., 1996).

Among other things, and more recently, Rajeswaran and colleagues investigated the MRIs of 98 asymptomatic elite young tennis players (51 men and 47 women) with an average age of 18 years, highlighting anomalies in the pars interarticularis in 29.6% of subjects examined, with spondylolisthesis in 5.1% of players (Rajeswaran et al., 2014). Men had a higher prevalence than women (Rajeswaran, 2014). Alyas and colleagues, in a similar study, found lesions to the pars articularis, predominantly in level L5 (9/10-L5, 1/10-L4), in 9 tennis players out of a total of 33 subjects recruited for the study (Alyas, Turner & Connell, 2007).

The minute reconstruction effectively sanctions the dangerousness of the sport of tennis, i.e. a sport that stresses the spine in hyperextension (service) and extension and forced rotation (forehand)[Lisi, 2018]. Over the years, the paroxysmal obsession, aimed at achievement of the result as an end in itself, has in fact produced considerable changes in the execution methods of a certain technical gesture. See the service and the law, which have become increasingly explosive and decisive. In the past, the forehand stroke was made using the traditional closed stance (Figure 1A). In this position, the transfer of energy evolves from the feet to the trunk through the ascending twist of the legs, and from the trunk to the shoulders until it reaches the racket (Lisi, 2018).

Many authoritative specialists, including Saal and Ruiz-Cotorro, believe that this technical approach significantly reduces the stresses at the level of the pars interarticularis (Saal, 1996; Ruiz-Cotorro et al., 2006) probably proving to

be safer from a biomechanical point of view than modern methods of interpretation of the fundamental where the tennis player impacts the ball frontally on the net (open stance - Figure 1C). In the latter case, there is in our opinion a potential increase in the speed of the ball at the expense of the integrity of the spine, especially in genetically and anatomically predisposed subjects (Lisi, 2018). However, the onset of this pathology is absolutely subjective and correlated to multiple factors which, both acting alone and jointly, can determine the damage (Denard et al., 2010; Bhalla & Bono, 2019). It is possible to act preventively on some of these contributing causes, while other etiological aspects are not very editable.

If in fact the closure of the growth plates at this level occurs between the ages of 7 and 12 and it is therefore possible to focus attention on the onset and evolution of spine-related problems in this particular age range, it is equally clear that a further area of action is to be framed in the training methods, in particular as regards intensity and frequency, bearing in mind that the right exercise, performed by extension and forced rotation of the rachis, causes an overload of the posterior arch of the vertebra (Ruiz-Cotorro et al., 2006). Likely, such occurrence is expressed in predisposed subjects, in which functional overload induces stress pathology (Ruiz-Cotorro et al., 2006; Denard et al., 2010). In fact, like all stress fractures, the same training loads may or may not determine the problem in different types of subjects as a function of notable variables: such as muscular conditions, equipment, personal anatomical conditions and, last but not least, predispositions on a hereditary basis (Albanese & Pizzutillo, 1982; Friberg, 1987; Newman, 1963; Wynne-Davies & Scots, 1979).

In some cases, when the gesture in question is perpetrated, under the action of load and muscle traction, the vertebral body, pedicles and upper articular processes slide progressively forward; while the lower articular apophyses, the laminae and the spinous process remain in place, giving rise to the olisthesis. Therefore, the aetiopathological connection between these pathologies and the typical strokes of tennis, in particular the forehand, is found not in a precise traumatic event, but in an absolutely progressive triggering gesture on a substrate of multiple predisposing factors (Lisi, 2018; Ruiz-Cotorro et al., 2006). Basically if genetic aspects, at least at the moment, are scarcely modifiable, there is a wide field of action involving the techniques of preparation and management of the athletic gesture, implying the need for a constant clinical and technical follow-up of the athlete, done constant in professionals but still very far from reaching in amateurs, where the assistance of a multidisciplinary team (physiotherapist, psychologist, doctor) who collaborates with trainers is almost always absent and constantly neglected in the occasional tennis player.

PRACTICAL APPLICATIONS

Based on the review of the Literature and our personal practical and theoretical-clinical experience, the evidence is, in our opinion, that amateur players should use closed positions to hit forehand. This technique may lead to better results related to the target of this particular category of players, avoiding physical damage that can lead to a long stop in sport activities.

In this regard, instructors are invited to focus on some technical aspects, which are often underestimated: among these, the lack of use of the non-dominant arm (Figure 2B). It is evident how the correct use of the opposite limb improves the acquisition of the same technique in closed support, since it helps to rotate the trunk and, therefore, to position oneself perpendicular to the net (Figure 2A).

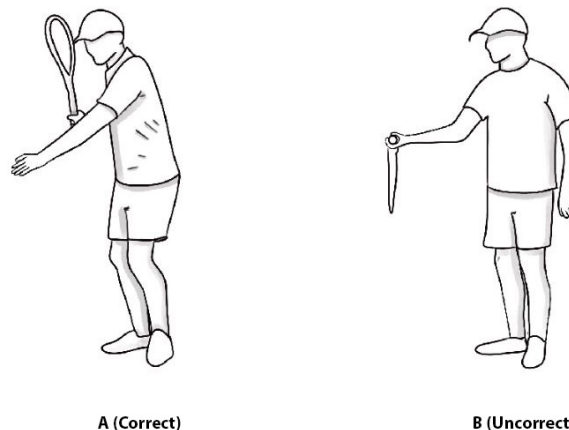


Figure 2. A. Correct forehand closed stance; B. Uncorrect tennis forehand closed stance.

CONCLUSIONS

When we talk about tennis we resort and refer without delay to the typically professional activity. That tennis, in other words, characterized by actions of short and very short duration (Gallozzi, 1992). But tennis, in the most global sense of the term, is also that of the Sunday amateur - who hopes to be able to prevail over the Club member without endangering his physical safety, dribbling for hours on one of the many clay courts of the suburbs - or that of our veterans. Who, although they don't express the same excellence in terms of performance as the more paid and noble colleagues on the professional Tour, still manage to be satisfied and satisfied. In the present work, the general principles and the theoretical premises of reference, therefore, find their practical justification in amateur tennis players, junior and senior (veterans), also in consideration of their lower speed of play compared to that of their professional colleagues. In fact, the latter often resort to the open position precisely because of the speed of play which, being particularly high, leaves little time to execute a given shot: the tennis player thus assumes the position deemed most convenient.

More convenient, sure, but not always the safest in terms of physical well-being. If, as far as professional tennis players are concerned, it is not at all unusual for players to be forced to change pitches within a week or two, given that tournaments take place in numerous locations around the world and on different surfaces (passing, for example, from the red clay of Roland Garros and the European tournaments to the grass courts such as those of Queen's and the German Halle) even the amateur tennis player can find himself, by chance or for contingent needs due to the availability of playing fields or invitations by friends who frequent different clubs, playing on different surfaces (rarely grass, but very often clay or synthetic surfaces of various kinds) and consequently

different responses to player interaction (Lisi, 2009; Lisi, 2016). These sudden changes, due in the first case to an increasingly dense tennis calendar and in the second to chance, often associated with a dangerous discontinuity in the activity, and the impossibility of adapting in such a short time to this or that specific surface, can cause, if not more or less disabling injuries, algic symptoms of various kinds affecting the musculoskeletal system (Lisi, 2016; Lisi, 2018). Furthermore, it is necessary to remember that in the tennis practice of amateurs, juniors and overs, and in their interaction and integration with different terrains, the playing technique and physical preparation (often in this case poorly maintained and balanced) are integral and predominant factors in assessing the risk of possible damage.

There is no doubt that a tennis player who has reached a certain age, or an athlete who occasionally practices the sport of tennis, is required to strictly comply with some general rules in order to be able to continue his sporting activity without risk. But an accurate technical setting of the basic strokes is equally important. The veteran and the amateur tennis player (or the Sunday sports lover), assuming at least the partially open position (semi-open stance – Figure 1B), will thus be able to practice the sport less tiringly, to preserve the neuro-muscular system- skeletal system, reducing the risk of contracting injuries and, at the same time, improving performance on the court (Lisi, 2018).

CONFLICT OF INTEREST AND FUNDING

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