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Role of Sport in the correct posture

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Abstract

La postura corretta e il suo controllo sono aspetti da tenere in considerazione anche nell'ambito della pratica sportiva. Ogni attività sportiva, sollecita l'apparato muscolo-scheletrico e gli effetti di queste sollecitazioni possono essere amplificati se chi li effettua non è in grado di assumere posture bilanciate e corrette. Possedere un buon controllo posturale ci consente di mantenere il corretto rapporto tra gli arti e, soprattutto la conservazione delle curve fisiologiche del rachide. Le sollecitazioni risultano essere dannose anche nel caso in cui l'atleta non possieda una buona preparazione atletica o manchi di un'adeguata preparazione tecnica. L'acquisizione di una postura adeguata passa obbligatoriamente attraverso la conoscenza delle posizioni corrette, ma soprattutto attraverso l'allenamento del corpo ad assumere tali posizioni in ogni situazione, anche nella pratica dell'attività sportiva.

The correct posture and its control are aspects to be taken into consideration also in the field of sports practice. Every sport activity, stresses the musculoskeletal apparatus and the effects of these stresses can be amplified if the person performing them is not able to assume balanced and correct postures. Possessing good postural control allows us to maintain the correct relationship between the limbs and, above all, the conservation of the physiological curves of the spine. The stresses are harmful even if the athlete does not have a good athletic preparation or lack of adequate technical preparation. The acquisition of an adequate posture passes through the knowledge of the correct positions, but above all through the training of the body to assume such positions in every situation, even in the practice of sporting activity.

Keywords

Correct Posture; Sport; Musculoskeletal Apparatus

Postura Corretta, Sport, Apparato Muscolo-Scheletrico

1. The Posture

Posture is the position of the body in the space and the spatial relationship between the skeletal segments, whose aim is the maintenance of equilibrium both in static and dynamic conditions, which contribute to neurophysiological, biomechanical, psycho-emotional and relational factors, also related to the evolution of the species (1). In this definition we underline some fundamental aspects of posture: the concept of spatiality, the concept of antigravity and balance, the static and dynamic condition, the neurophysiological, biomechanical, psycho-emotional and relational factors, the evolution of the species.

Gravity is the fundamental external force for posture regulation, and in some ways postural balance is the body's response to gravity. When body weight is reduced, as in water, postural reactions tend to disappear. The effects of gravity in the upright position are clearly evident in the absence of gravity: astronauts' experiences in space flights show very different postural attitudes compared to the habitual ones on earth, with radical modifications of the postural tone. The antigravity reactions of our organism are expressed in posture and equilibrium, very close but not synonymous terms.

The equilibrium can be understood as the optimal relationship between the subject and the surrounding environment, in which the subject, both in static and dynamic conditions, adopts the most adequate posture, instant by instant, with respect to the environmental requirement and the pre-set objectives . It is essential therefore that the subject adopts an appropriate posture to have a good balance, even if an alteration of the posture does not necessarily imply a disturbance of the balance (2).

Posture is a more "static" attitude with very limited limits of oscillations, while equilibrium is a more "dynamic" attitude that can be maintained with larger oscillations, which require a series of postures in which the position of the body barycenter still falls within the supporting polygon(3).

The complexity of posture therefore derives from numerous factors that intersect each other:

- possible pathological condition,
- impaired muscle balance,
- presence of a trauma that caused tissue or bone damage,
- physical component and sporting habits,
- environmental and work factors,
- hereditary conditions, psychic and character factors.

It is necessary to clarify that there is not a single type of posture, but an unlimited number of postures. They correspond to any "balanced position" with maximum stability, maximum economy (minimum energy consumption), and maximum comfort (minimal stress on anatomical structures).

2. Mechanisms that regulate posture

The control system of balance and posture substantially coincides and corresponds to the control of muscle tone, thus forming the postural tonic system. The postural tonic system allows the man the postural stability, both in static position and in movement, adapting itself to the continuous environmental changes (4).

To achieve this, the system uses a complex network of resources divided into 3 levels:

1. sensory receptors (cutaneous exteroceptives and, visual, vestibular and auditory proprioceptives) that arrange the various parts of the body in relation to the whole and to the environment;

2. higher centers (vestibular nuclei, cerebellum, formation or reticular substance, cerebral cortex) that integrate and re-elaborate data from previous sources (5);

3. effectors (oculomotor cranial nuclei from which commands to oculomotor muscles for visual stabilization start, and the spinal cord from which direct signals to the motor's driving plates start.

The control system of the equilibrium continuously elaborates a control on the muscles with the purpose to produce the most congenial posture for the activity, the movement or the situation that must be faced (6).

The muscles of our body are divided into dynamic muscles and static muscles. The dynamic musculature is the one responsible for the execution of the movements, while the static musculature is involved in the control of the posture (7).

The most important static muscles are the antigravity muscles, such as the sural triceps, the anterior rectum, the ischium-crural, the pelvis-trochanterics and the spinal muscles. These muscles form the posterior static muscle chain. This musculature has the task of working against gravity and maintaining the verticality of the body.

Other muscles instead have the role of "suspending", especially the scapular girdle and the thorax, such as the scalene muscles, upper trapezius, intercostal and also the mediastinal fibrous muscle system that suspends the frenic center. These muscles form the anterior static muscle chain (7).

These two posterior static and anterior static muscle groups to perform their function must also develop capacities different one from the other. Those postural must be especially resistant, while the dynamic ones must be strong. From this concept we deduce that we can not apply the same training method for the two muscle groups. In fact, the training of the muscles that regulates the posture will have to provide different programs than the traditional ones that develop the dynamic musculature. The muscles of the dynamics will always have to be exercised in concentric contraction to be strengthened, while the muscles of the statics will have to be exercised in lengthening.

3. Body segments that influence postural position

The Foot

The foot is the body segment in contact with the ground on which the full weight of the body weighs, it allows the man to assume the upright posture and to move in space.

The cutaneous exteroceptors of the foot are highly sensitive receptors and represent the constant interface between the environment and the postural tonic system. In fact, the plantar information is the only one to derive from a sensorial receptor in direct contact with the ground.

The cutaneous stimulations of the sole of the foot are able to activate and modulate very complex reflexes with very important postural functions (8). The foot, therefore, is considered the main organ of sense and motion of the human body, as demonstrated also in the motor and sensory representations of the "homunculus".

The lower limb, including the foot, in the course of evolution for the needs arising in the assumption of the upright position and of the bipodalic ambulation, has acquired, as a peculiar characteristic of the human race, the attitude to stiffening.

The human foot then evolves from a prehensile form to the current antigravity form preserving the complexity of its musculature (9).

Environmental information probably flows into the genetics that gradually stores it, over the generations, improving the genesis of antigravity prerogatives. However, the cultural factor interferes with this development by altering environmental information (creating inadequate terrain and shoes), thus causing an evolutionary disruption.

The posture of the human body is a continuously unstable system (10). The large distance of the center of gravity to the narrow base of support and the long body structure are factors that contribute to instability

The foot is interposed between external forces (environmental) and internal forces (muscu-

lar) that meet in it, contrast and finally merge for the affirmation of the condition of equilibrium.

In short, the foot is a structure able to absorb and displace the forces, relative to the infinite planes of space (8).

The foot, in its role of "antigravity base", at first makes contact with the support surface by adapting to it, releasing itself, then stiffens, becoming a lever to "repel" the surface itself.

The foot must then alternate the release condition with the stiffening condition. The alternation of laxity-rigidity justifies the analogy with the variable pitch propeller.

In fact, the retropod and forefoot are arranged in planes that intersect in a variable way. In the ideal condition, the hindfoot is placed vertically and the forefoot horizontally (on a horizontal supporting surface) (11). On foot under load the torsion between the back and forefoot is attenuated in relaxation (the foot becomes a modeling platform) and is accentuated in the stiffening (the foot becomes a lever). The arc arrangement is actually apparent, being an expression of the degree of winding of the podica propeller. The foot therefore does not have the meaning of a real but apparent vaulted arch, which rises during the winding and lowers during the unfolding of the helix (12,13). The winding of the propeller, with the consequent accentuation of the apparent arched arrangement, corresponds to its stiffening. The unfolding of the helix, with consequent attenuation of the apparent arc, represents the release. The torsion (envelopment) of the podica helix is connected to the external rotation (extrarotation) of the suprapodalic segments (leg and femur). The astragalus rotating outside solidly with the bones of the leg, rises on the heel, thus closing the mid-tarsic articulation; the hindfoot is verticalized. The forefoot adhering tenaciously to the ground reacts to the twisting forces applied on the hindfoot; the foot is then stiffened (12,13).

The stomatognatic apparatus

The stomatognathic apparatus with its main functions of mastication, phonation and swallowing and, in a complementary way, respiration, is closely integrated with the postural tonic system. It is in fact now scientifically established that occlusal errors (malocclusions) or stomatognathic dysfunctions are able to create more or less serious postural imbalances, even if the authors agree in the difficulty of identifying these correlations in a precise manner (14).

The most important arguments to support the hypothesis of the existence of a vertebral skull system are:

- The stages of the long phylogenetic path of man seem to reproduce at great speed in the first years of life of the children. The changes in the morphology of the skull and the face correspond to a parallel change in the spine (the foot is responsible for changes in the vertebral curves) and therefore in the posture.
- The stomatognathic apparatus, like the foot, represents a point of union between the anterior and posterior muscle chains inside the myofascial system. It should be emphasized the role of "pin" played by the hyoid bone which is placed in the front of the neck, a few centimeters below the jaw, superiorly contributes to the floor skeleton of the oral cavity where the root of the tongue originates, below it is connected to the thyroid cartilage through the robust thyroid membrane. The hyoid bone appears as a point of convergence of beams and muscles of the cranio-cervicofacial territory that joins the mandible (the only mobile bone of the head) with the back of the skull, with the sternum, with the clavicle and with the scapula, the muscles above and below the hyoid. It is also connected to the styloid process of the temporal bone through the styloid ligament and is anatomically and functionally linked to the tongue through fibromuscular structures.
- The amplitude of the cortical area reserved for the face, tongue and related functions, as shown by the homunculus (more than 50% of the area of the motor and sensory homunculus is represented by the feet and the stomatognathic apparatus), and the presence of the most diversified innervation, composed of 5 cranial nerves (trigeminal, facial, vagus, hypoglossal and glossopharyngeal).

The balance of the jaw is dependent on the posture and, in particular, is strongly influenced

anteriorly by the "lingual posture" and posteriorly by the cervical posture. Jaw, cervical tract and tongue actually form an inseparable functional unit and should be examined as such (15).

It is therefore necessary to bear in mind that any intervention concerning the mouth is not limited to this location but affects the cervical area and therefore the whole posture.

The relationship between the mouth and the extra-metabolic pathway travels in the two directions passing through three crossroads that are: cervical, jaw and hyoid bone which is, in turn, closely connected to the tongue. Everything that occurs in the mouth is reflected, through the temporo-mandibular joints, on the cervical tract thus affecting the scapular girdle, the vertebral column up to the feet and vice versa (16).

Whatever the postural imbalance, it will carry tensions in various bodily districts in a circular manner (from the bottom to the top and vice versa) always involving the mouth and the foot (the backfoot in a particular way).

To better understand the biomechanical correlation between posture and occlusion it is important to remember that the striated muscles of the body can change their action depending on the head that is fixed for the stabilization of the bone segments on which it is inserted (17).

The whole physiology of the mandibular movement is based on this fundamental concept: the muscles that take insertion on the jaw move starting from two possible fixed points, the skull and the hyoid bone. In the presence of correct postural alignment, we will have a stabilization of the head on the cervical, thanks to the harmonious function of the extensor muscles (spleni, long muscle of the head and neck, semispinal, rectus and oblique muscles of the head or sub-occipital, muscles of the back) and flexors (sternocleidomastoid, scalene) of the cervical tract and of the hyoid bone (suprahyoid muscles and below the hyoid) (17).

In this situation, the temporal muscles, masseters and internal pterygoids contracting elevate the jaw, taking the skull as a fixed point, while the contraction of the supra-oral muscles lowers the mandible (fixed point on the pharynxoid-rachis complex). It is easy to understand that in case of incorrect posture, in which for example anteriorization of the head is present (with cervical rectilinization), we will have a decompensation of basic muscle tone between the anterior and posterior muscles of the neck (and therefore of the respective muscular chains) to which a habit is often added to the mandibular frame (from stress), which will affect, in particular, the atlanto-occipital articulation and therefore of the stomatognathic apparatus (18).

4. Principles of postural gymnastics

Postural gymnastics acts on the subject to which it is directed to improve posture, body control and to allow its best use. The postural exercises are designed to improve both the knowledge of your body in general, and the image we have of it, through the perception of the characteristics of the rachis, the lower and upper limbs in addition to the positions that these body segments take in space.

Muscles that are mainly involved in postural gymnastics are the muscles of static, whereas usually, in sports, as in traditional gymnastics, the muscles of dynamics are activated (19). The latter concern the superficial layer, their main task consists essentially in the execution of movements, the muscles of the static instead are deeper (and shorter) and must support the bone structure in the continuous opposition to the force exerted on our body by gravity to maintain the verticality of the body. Their activation is different and, if the muscles of the dynamic must be trained to become stronger, the antigravity ones will have to become more resistant. The postural muscle contraction is used to improve awareness and quality of movement by seeking control of the best posture. Repetition in the exercise is sought only in order to achieve mastery of the correct posture automatically (20). Breathing is an integral part of postural exercises, in addition to shaping the rhythm. Every postural work focuses on the respiratory muscles, particularly on the diaphragm. There have been and still are several schools to deal with posture. Among the most significant, we mention the "Back School", born in Sweden and conceived by

Mariane Zachrisson Fossel, and the Pilates method, much followed today, which focuses on the awareness of your body and its center of gravity, seeking control , the precision and fluidity of the movement marked by the respiratory rhythm. To whatever school you refer, the objectives of a correct postural gymnastics program must be:

- to improve the perception of the body: if you want to improve your posture, you need to focus on yourself and understand what the starting point is, that is to feel the support of the feet on the ground, any muscular tension, the position of the head and the shoulders with respect to the rachis.
- to acquire awareness of one's postures: once the ability to perceive one's body is refined, it is necessary to observe how it moves, both in everyday life and in sport, to assume incorrect postural attitudes, so as to correct them.
- to improve joint mobility and muscle elasticity: the lack of joint mobility and the lack of elasticity found in some muscle groups, can prevent the achievement and control of a correct and economic position.
- to improve the action of postural muscles: it is one of the fundamental tasks of postural gymnastics; they will have to become resistant and recognizable, so that they can be activated correctly when necessary.
- to improve postural ability: it is necessary to exercise the ability to know how to take and control the most correct posture in daily actions, until it becomes an automatism.

Postural gymnastics may be useful as a cure and prevention especially for musculoskeletal discomforts, such as scoliosis, lumbago, sciatica, cervicalgia, scapulohumeral periarthritis, arthrosis and osteoporosis. In addition to this use, it can become an integral part of a normal sports training, so as to be a means to prevent certain injuries or diseases from overload (21).

The postural exercises, in fact, are static exercises that allow a strengthening of the whole musculature of the trunk involving, therefore, abdomen and back. The exercises result in this way useful for two reasons: to increase the tone of the musculature of the trunk, also touching the deep muscles of the back, which are very stressed in the jumps, and to prevent back pain, especially in jumping sports such as volleyball or basketball.

5. Postural gymnastics applied to sports

The correct posture and its control are aspects to be taken into consideration also in the field of sports practice. Every sport activity, stresses the musculoskeletal apparatus and the effects of these stresses can be amplified if the person performing them is not able to assume balanced and correct postures. Possessing good postural control allows us to maintain the correct relationship between the limbs and, above all, the conservation of the physiological curves of the spine. The stresses are harmful even if the athlete does not have a good athletic preparation or lack of adequate technical preparation.

The acquisition of an adequate posture passes through the knowledge of the correct positions, but above all through the training of the body to assume such positions in every situation, even in the practice of sporting activity (22).

The philosophy of the Back School provides that anyone who practices this gymnastics learns to know its spine and to use it correctly even in daily movements, acquiring the ability to adopt the right compensation (23). All the more so, these skills can and must become the assets of those who play sports, in such a way as to adapt the correct postures to the practice of the activity (23).

In sports practice it is important that anyone involved in the physical preparation of athletes, be careful to structure an accurate program, which has as a first requirement a preventive character in relation to the main functional overload disorders and as a second requirement the strengthening of the muscles, to obtain a base on which to engage the correct technical gesture (24).

In various sports the rachis undergoes compressive, cut and distraction forces following the fallout from the jumps, to the execution of more or less repeated and demanding technical gestures (19).

One way to prevent these injuries is the postural gymnastics, through which you can teach the athlete to distinguish a correct postural situation from an incorrect and potentially harmful, but at the same time you can go to work on the most stressed structures to "download them" or to strengthen the muscles involved in protecting the delicate spinal structure. The coach or the athletic trainer should firstly be concerned with correctly programming the frequency, intensity and duration of the training sessions and competitive commitments. The initial part should be characterized by a good warm up, followed by stretching exercises, while in the breaks and at the end of the workouts you should perform decompression exercises for the intervertebral discs. These are essential to ensure the hydration of the nucleus pulp and to relieve the stressed structures.

Conclusions

The postural tonic system, thanks to complex mechanisms, is a system that can unbalance with extreme ease for various causes, triggering a series of compensations and adaptations even at a distance. A functional posture does not involve pain, a dysfunctional posture is basically algic.

Postural analysis can also be performed with simple tools and should be the starting point for practicing any sporting activity. Knowing the athlete from the functional and postural point of view will help to set up training programs in respect of the structure of the human body, while seeking the improvement of sports performance.

Sport as it is understood today, aims at success and results. Very often, these to be achieved, involve training aimed solely at improving physical and athletic characteristics, ignoring the aspect of injury prevention and health of the athletes, exposing them even more to the appearance of overload injuries. In fact, it is not uncommon to see high-level athletes who at a certain point in their sporting career can no longer achieve the desired performance due to rigidity, blocks or functional limitations, resulting from incongruous training. These can also occur when a sport is given to people who already start with postural changes. Just the postural component must constitute a phase of preparation and support for the subsequent construction of the technical gesture. The athlete's body must have harmony and symmetry of the structural components and muscular functions.

The essential premise for a correct, effective and non-injurious sport is a good control of posture that can be achieved through postural gymnastics. The exercises that characterize it involve the muscles of the static and their contraction is used to improve the quality of the movement. When performing the exercises, we check the position of our body and the main objective is the quality of the movement.

The athlete must acquire correct postures that, once automated, can be performed at maximum speed, as required in competitive sports. Other postural exercises are helpful to relieve the structures mainly involved in sports practice and serve in particular, to rehydrate the intervertebral discs and bring benefits to the entire spine. In fact, we must not forget that the rachis is the crucial point of the body axis and is considerably involved in postural phenomena.

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