

THE FOOT GROUND REACTION ON THE SOCCER AND RUGBY PLAY'S

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INTRODUCTION

Football and rugby are sports of movements and contact where the basic aim is to gain possession of the ball, with which the principal act of the game must be accomplished: that is the scoring of the goal. In football, which belongs to the group of the sports with equipment, there are technical moments of the run dominating the ball, the piece of equipment, and others during which there is no contact with it. The composition of these actions is very complex, both so far as the neuro-motorial content is concern, and relative to the metabolic energetic involvement. The body's motion must be interpreted as a succession of elementary movements that can be studied as the combination of translational and rotational motions. The correct expression of a motion is dependent on the balance between internal and external forces. The vector and scalar characteristics of the reaction are related to the physical and mechanical characteristics of the two structures coming in contact. The evaluation of ground reaction forces and their location relative to the joint centres is a necessary information for evaluating human motion. This information is obtained by means of a force platform. These techniques are certainly very useful, allowing a more detailed analysis of the forces acting on different locations of the foot.

METHODS AND MATERIAL

The analysis is performed during the normal strike and the running of the soccer and rugby player. We have used a dynamometric Kistler platform that provide the complete progression of the foot-ground reaction which develops during the stage of placing of the foot on the ground. Usually, from 3 to 5 recording were used for each trial condition, so as to pinpoint the most recurrent and representative characteristics of the dynamics of the lower limb and relative foot-ground reaction. The transducers of Kistler platform consist of quartz elements (piezo-electric effect) mounted under pre-stressed hinge. It allows the measurement of three ortogonal components of any force acting on the platform, the coordinates of the instantaneous point of force application and the torque whit respect to an axis normal to the platform. The characteristics are high sensitivity and linearity, low histeresis and cross-talk, and very high natural frequency. It can be operated at a very wide range of temperatures. 24 soccer players of Italian national team and 40 soccer players with high ability and performance and 50 rugby players have been examined and the tests are correlated with a control reference group of normal subjects.

RESULTS

The analysis of the soccer players' foot-ground reaction on the sagittal plane has revealed: during the normal strike an impact phase characterised by high maximum force (148 +/- 3b.w.) and high velocity of progression of application point (138 mm/sec). A support phase characterized by a lower velocity of progression of application point (80 mm/sec) compared to the impact phase and by the backward inclination of vectors. A propulsive phase with a presence of a peak of force lower than the first one in the contact phase and with rotational moment significantly increased compared to the normal. The trace diagram shows a wider extension of international rotation during the contact phase and a movement with a predominance of an external rotation during the support phase. The analysis of the rugby players foot-ground reaction has revealed on the sagittal plane: during the normal strike a contact phase with high maximum force (133 +/- 3b.w.) and high velocity of progression of application point (120 mm/sec). In comparison with soccer players ground reaction the data show reduced values of force during the impact phase. The support phase shows a backward inclination of vectors and a reduced velocity of progression (75 mm/sec) compared to the impact phase. The propulsive phase demonstrate the presence of a peak of force equal to the first one during the contact phase. On the horizontal plane, the trace diagram shows a normal extension of internal rotation and a significantly extension of external rotation.

CONCLUSION

The kinetic characteristics of gait mechanics provide more direct insight of how muscular forces generate and control the movement of the body. The ground-foot reaction reflects the net effect of muscular action and segments acceleration while the body is in contact with the ground. The ground reaction pattern of the professional soccer player is repetitive, typical and different by the pattern of the vectorial diagrams of the rugby player.

REFERENCES

- Kistler Instruments A.G. (1985) Multicomponent measuring platform for biomechanics and industry. Type 9261A, Amherst, New York.
- Oberg B., Ekstrand J., Moller M., Gillquist J. (1984) Muscle strenght and flecibility in different position of soccer players. *Inst. J. Sports Med.*, 5: 213-216.
- SagginiR., Calligaris A., (1989) Analysis of running in soccer players; Symposium on Biolocomotion, Formia.