

COMPARATIVE EVOLUTION OF ANGULAR POSITIONS DURING HALF SQUAT EXERCISE.

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INTRODUCTION

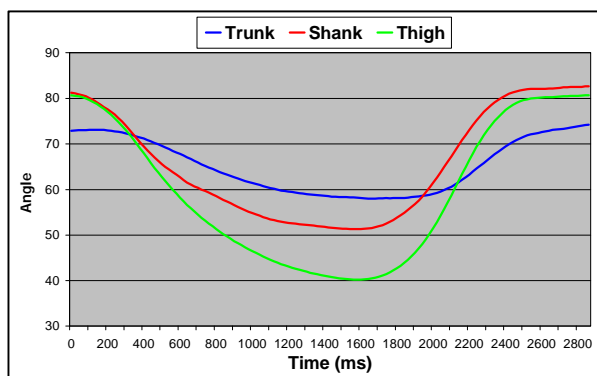
Forces induced on knees and spine depend on the position of the trunk and the lower limb during lifting exercise (Poumarat and al. 1989). This study was conducted to determine the different evolutions of segmental angular positions between expert and non-expert during half squat exercise.

MATERIALS AND METHODS

7 experts [29.4 ±5.7years, 170.8 ±3.8cm, 70.2 ±9.5kg] and 16 non-experts [22.8 ±2.7years, 181 ±5.9cm, 75.4 ±7.1kg] performed 3 sets of 3 repetitions with respectively no additional weight, 50% and 75% of body weight ; followed by 2 sets of 10 repetitions with 100% and 120% of body weight. Saga-3 3-D system was used to analyse kinematic data, and to determine angular displacements for trunk (T) right hip (H), knee (K), ankle (A), and angle between thigh and ground (Tg) during each exercise. This 3-D system is made up of 4 cameras CCD at 50Hz.

RESULTS

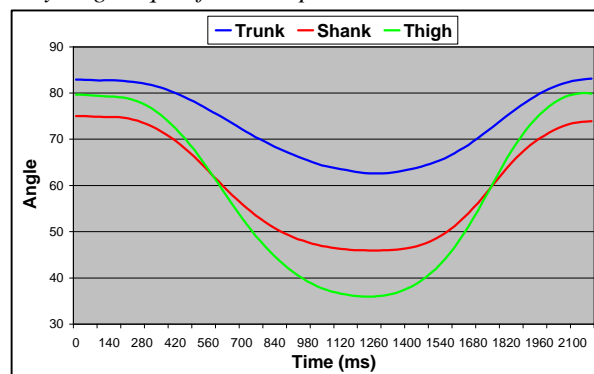
Figure 1: evolution of the angular variations of T, A and Tg, during the last repetition of 120% of bodyweight squat for the non-expert.



For low additional weight (0, 50 and 75% of body weight) , the trunk flexion stays close or equal to 30 degrees for the non-experts, and this value increases dangerously during the last repetitions of the 100% and 120% sets. Furthermore, even if at the start and at the

end of the movement the A flexion stays similar to the Tg angle; during the movement the ankle flexion becomes less prominent than the Tg angle (*figure 1*).

Figure 2: evolution of the angular variations of T, A and Tg, during the last repetition of 120% of bodyweight squat for the expert.



For the experts the T flexion remains always under 30°; in comparison with the non-expert, the evolution of the Tg angle is more important (*figure 2*).

The results indicate that the non-experts use mainly their low-back, above all during heavy loaded squats, which increases the risk of injuries.

During the 100% and the 120% sets, for non-experts, there is an increase of the angle at the level of the knee joint; the subjects reach 90° for the first repetitions, but they stay above 90° for the last.

DISCUSSION AND CONCLUSION

The hyperflexion of the trunk is an indicator of a lack of technique and/or of a neuromuscular fatigue, these two parameters affect the correct execution of the movement, above all for the heavy loaded squats. It's necessary to pursue this study to determine and compare the order of muscular activation during the movement, and to determine how much this order may alter the movement safety.

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