IS DEEP SQUATTING SAFE FOR THE KNEES? BIOMECHANICAL FEATURES OF EXERCISE "SQUAT"

UDC:796.012.82.6

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Abstract

Today in sport practice are present conflicting views on the safety of the exercise squat for the knee joint and its internal structures . Very often is thought that deep squattingis harmful to the knees, and therefore many coaches avoid to engage this exercise in their training sessions with recreational and professional athletes. This paper is a review of relevant studies that treat this problem. From their analysis of the resulting it can not be certainly argued whether deep squat is risky for the knee joint, but significantly larger number of studies emphasize the opposite , that deep squat is safe , especially if those who practice this exercise do not have some serious health knee problems and the exercise is performed properly and under the technical supervision of an expert .

Key Words*: exercise, biomechanics, risk, joint.*

Introduction

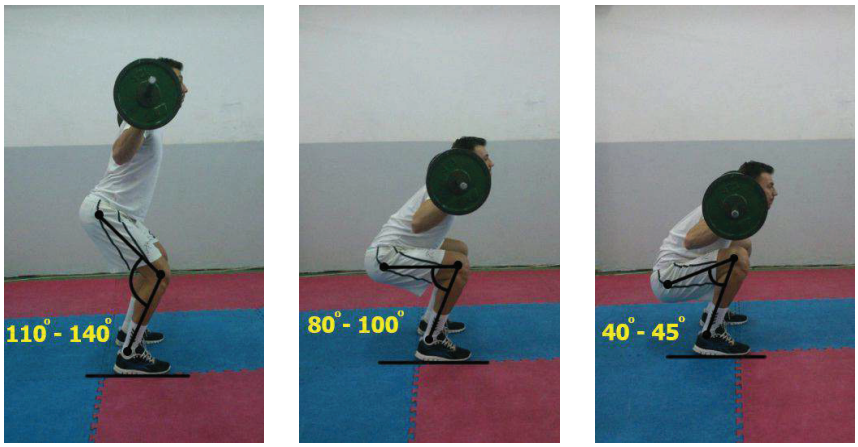
Squatting or exercise known as " Squat " represent one of the most common and basic in conditioning , whose primary goal is to strengthen the muscles of the thigh (extensors in the knee joint) and gluteal muscles (extensors in the hip joint). Often in the literature are seen diverse views and conflicting arguments about "squat" exercise. Some experts believe that squatting especially deep is not safe for the knee, while others believe that this kind of exercise is safe.

Biomechanical science within its methods of research uses computer simulation and modeling for obtain information that can not easily be obtained from experiments. The information relating to the strength of the muscles , ligaments , the strength of the joint, joint reaction force are just some of the information needed for the study of human movement (Abernethy et al. 2013) .

In this paper is made a review of the exercise squat through review of literature which treats the risk of injury to structures in the knee.

Dicussion

In terms of range of motion in the knee joint the squatting is divided into partial squat (Figure 1a) - when the joint angle of the knee is 110 to 140 degrees , parallel squat (Figure 1b) - when the angle of the knee joint in a 80 to 100 degrees and deep squat (Figure 1c) - when the joint angle of the knee is 40 to 45 degrees (Hartmann, 2013) .



a *b* *c*

Figure 1. Squat range of motion

The claim that "deep squatting is not safe for the knees " stems from research at the University of Texas, stating that weightlifters who often practiced deep squat have problems with stability of the knee ligaments (CL collateral and anterior cruciate ligament ACL) compared with the control group (Klein, 1961). The author concluded that under the parallel squat has a significant impact on the stability of ligaments and therefore should be avoided .

In the next period, a number of studies show something else or that deep squat increases the stability of the knee joint (Soleyn, 2013 ; Chandler et al. 2001 ; Meyers, 1971 ; Panariello et al. 1994 ; Steiner et al. 1986) . Contrary to the claim of Klein the forces in the anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL) decreases with increasing of the angle of flexion in the knee joint .

The reducing of forces in anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) is presumed as a result of the influence of the rear - upper part of the tibia with the posterior femoral condyles and the compression of the soft tissue structures including the meniscus, capsule , muscle , fat and the skin (Zayontz et al. 2004) . Thus, it can be concluded that the risk of injury to the ligaments in the knee is higher in parallel squat , given that in this case , the forces in posterior cruciate ligament (PCL) culminate .

As conclusion we can say that deep squatting is contraindicated for those who have health problems with the knee. Those who have problems with the posterior cruciate ligament (PCL) should not be squatting lower than 50-60 degrees, until the complete recovery (Schoenfeld, 2010) . For problems with anterior cruciate ligament (ACL) the squat should not be lower than 50 degrees (Escamilla, 2012) . More in the practice of surgeons and physical therapists present application of exercises in a closed kinematic chain , as squatting which aims to strengthen the muscles of your thighs , after injury to the anterior cruciate ligament (ACL) (Abernethy, 2013) . Deep squatting is contraindicated in disorders like chondromalacia , osteoarthritis , osteochondritis.

In one of the studies was made a review of 164 scientific papers published in the period 2011 to 2013, was aimed among other things to be determined whether partial squatting is safer for the musculoskeletal system in terms of deep squatting (Hartmann et al. 2013) . The authors concluded that it is not found degenerative changes in patelo-femoral complex or a high risk of chondromalacia, osteoarthritis and osteohondritis in deep squatting . Contrary to claims, the deep squatting does not contribute to increased risk of injury to the passive tissues. Also, it was established that if the deep squat is technically performed properly under control of expert, with progressively increasing load , then it is an effective exercise for injury prevention and strengthening of the lower extremities .

Conclusions

Security in exercises is of primary importance in planning, programming and implementation of the training. The answer to the question " Is deep squatting risky for the knees " is important for every athlete, coach and recreational people, given that the knee joint frequent injuries occur .

However, although some may claim this is already a "myth", it can not be confidently said that deep squatting is absolutely safe for your knees , keeping in mind that the research methods that biomechanics involve computer simulation and modeling are complex and not a simple and quick way to answer the questions that have complex character, such as determining the intensity of the internal forces and their impact on soft and hard structures in the knee .

Considering the research results that were previously mentioned, it can be concluded that if squatting or deep squatting is technically performed properly under control expert with gradually increasing load, then it should not cause risk of an injury to the structures knee.

References:

Abernethy, B., Kippers, V., Hanrahan, J.S., Pandy, G.M., McManus, M.A. Mackinnon, L. (2013). *Biophysical Foundations of Human Movement* -3rd Edition Champaign, IL: Human Kinetics.

Chandler, J., McMillan, J., Kibler, B.W. & Richard, D. (2001). Safety of the squat exercise.American College of Sports Medicine. Published online at: http://www.acsm.org/docs/current-comments/safetysquat.pdf

Escamilla, F.R., Macleod, D.T., Wilk, E.K., Paulos, L., & Andrews, R.J. (2012). Anterior cruciate ligament strain and tensile force for weight-bearing and non-weight-bearing exercise: a guide to exercise selection. *Journal of orthopaedic& sports physical therapy.*Volume 42.No. 3.

Hartmann, H., Wirth, K., & Kluseman, M. (2013). Analysis of the load on the knee joint and vertebral column with changes in squatting depth and weight load.*Springer, Sports Med* (2013) 43:993-1008.

Klein, K. (1961). The deep squat exercise as utilized in weight training for athletes and its effects on the ligaments

of the knee. *JARMR*.15(1).6-11.
Li, G., Zayontz, S., DeFrate, LE., Most, E., Suggs, JF., &Rubash, HE. (2004). Kinematics of the knee at high flexion angles: an in vitro investigation. *Journal of Orthopedic Research.* 27(6):699-706.
Meyers, E. (1971). Effects of selected exercise variables on ligament stability and flexibility of the knee.*Research Quarterly*. 42(4):411-422.
Panariello, R., Backus, S., & Parker, J. (1994). The effects of the squat exercise on anterior-posterior knee translation in professional football players.*American Journal of Sports Medicine.* 22(6):768-773.
Steiner, M., Grana, W., Chilag, K., & Schelberg-Karnes, E. (1986). The effect of exercise on anterior-
Schoenfeld, B. (2010). Tha biomechanics of squat depth.Published online at: http://www.nsca-lift.org/HotTopis/download/Squat%20Depth.pdf.*Publication Reviewer JSCR, SCJ, PTJ.*
Soleyn, N. (2013). Analyzing the squat.The Aasgaard Company.Published online at:
http://startingstrength.com/index.php/site/article/analysis_of_the_squat#.U2-qSoGSySo

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