

KNEE JOINT STIFFNESS AND PROPRIOCEPTION DURING PREGNANCY

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ABSTRACT

The study performed in the Department of Orthopedics and Department of Obstetrics and Gynaecology in Szeged regarding the physiologic changes occurring during pregnancy which influence the tension of the knee, the proprioception and balance are presented. Twenty-two pregnant and eighteen nonpregnant female volunteers took part in the study, measurements of arthrometry, stabilometry and position of knee joints were performed. These data are the second part of a research series to analyze the cruciate ligament tears, which are more frequent in females from a hormonal point of view than in males,

and to establish the appropriate prevention measures. The detected increased weakness of the knee and the weaker proprioceptive perception of the anterior-posterior direction could explain the higher risk of injury of the anterior cruciate ligament.

KEYWORDS: Biomechanics, females, knee joint physiology.

INTRODUCTION

Menstrual cycle physiology, proprioception physiology Women performing the same sport as men suffer 4-8 times more frequently anterior cruciate ligament (ACL) rupture.^[1] More etiologic factors (extrinsic and intrinsic) are responsible for the difference.

Extrinsic factors (anatomical differences, relatively higher sport activity, skill level) are relatively easier to modify like the intrinsic factors (hormone level, maximal oxygen consumption, max, lactate response, body weight, plasma volume, Hgb concentration., heart rate, ventilation).

Researchers suspect that estrogen and relaxin as intrinsic factors have profound effects on women's neuromuscular systems^[2] and the mechanics of soft tissue such as ligaments and tendons.^[3-5]

More studies suggest that the hormonal factor plays an important role in the elevated ACL injury risk.^[6-7]

In 2005 with the study group of the Let People Move Biomechanical Laboratory in Perugia we analyzed the hormonal factor of the possible reasons.^[8]

Between the phases of the menstrual cycle, we found no significant difference in ACL stiffness and proprioception (like most other studies).^[9-12]

Some other studies suggested a correlation.^[1,13-14] In the second phase of the study at the Medical University of Szeged, Hungary we analyzed the biomechanical properties of pregnant women because they have significantly higher sex hormone levels.

The purpose of this study was to find relationships between the higher sex hormone levels and knee joint laxity and proprioception.

During pregnancy, there are a lot of changes that take place in your body. Due to these physical changes, it is normal to experience knee pain and sore joints during pregnancy. This is pain is because of the extra weight your body is carrying which puts pressure on your joints.

Knee Pain during Early Pregnancy, where continue gaining weight throughout the nine months of your pregnancy. This will exert pressure on your uterus, joints, and ligaments leading to the start of knee pain during early pregnancy and the first trimester. Hormonal changes also play a key role in causing sore knees during early pregnancy.

Types of Knee Pain during Pregnancy

Here are some different types of knee pain during pregnancy –

- You may experience dull and continuous pain in your knees which may be occurring due to an injury to your ligaments and soft tissues. The pain can get sharper if your knee is stabbed by something sharp

- You may experience a pain in your knees which may be occurring if you stand or walk for too long resulting in achy joints

Causes of Knee Pain during Pregnancy

- Hormonal changes – During the third trimester, hormones are released to loosen up the pelvic ligaments and tendons in preparation for childbirth. They not only loosen up ligaments in the pelvic area but also cause looseness in other ligaments and tendons, including around the knees. The kneecap may not exactly track right, resulting in knee cramps while pregnant.
- The strain on veins – Pregnancy may increase strain or pressure on your veins in your knees and legs, causing knee pain
- Weight gain – The most common cause of knee pain during pregnancy is the gradual increase in your weight. It will put a strain on your knees, especially in case it is your first baby as your body will not be used to supporting the extra weight.
- Excess work out – If you exercise too much during your pregnancy, knee pain can develop. Exercises like squats are beneficial during pregnancy but also weaken the knees. Make sure to perform knee strengthening exercises as well after squatting.
- Injury – In some case, your knee pain can actually be the result of an injury like a strain or fall, and not because of your changing body. If you experience extreme knee pain, then consult a doctor immediately as it might be a serious injury.
- Excess walking or standing – Sometimes knee pain can be just due to excess walking or standing throughout the day. Your knees will be forced to carry the weight for longer periods of time that way and you will develop pain.
- Calcium deficiency – Calcium deficiency in your bones can also be the cause of knee pain in pregnancy
- Changed point of gravity – If you move or exercise too much during pregnancy, your body switches its center of gravity and put unbalanced pressure on your knees, causing pain.

Complications Associated with Pregnancy Knee Pain

- If not checked, knee pain during pregnancy can cause future complications:
- If you suffer from knee pain during pregnancy, you stand a risk of developing osteoarthritis later which is a degenerative joint disease which occurs due to wear and tear

of cartilage around the knee. This disease will cause joint stiffness, locking of knee joints and severe pain.

- Too much extra weight will put pressure on the knees and cause damage to the protective cartilage and ligament around the joints. This can cause difficulties with walking, bending and running in the long run if left unchecked.

Knee Pain is Treated during Pregnancy, by the following tips;

- Knee pain is usually due to one of two reasons – either due to an injury or due to effects of your pregnancy. The former needs medical intervention but the latter can be treated in the following natural ways.
- Knee strengthening exercises can help in treating the knee pain
- Eat calcium-rich foods to sustain and balance the amount of calcium in your body
- Check not to put on excess weight
- Try placing a heating pad or ice pack on your knees for some relief
- Keep your feet up most of the time and take plenty of rest
- Consume more omega-3 rich foods and herbal supplements in with your daily meals. For this, remember to consult a doctor first.

Home Remedies for Knee Pain in Pregnant Women, where the good thing is that these pains will subside after you have delivered your baby. But till then, here are a few home remedies to alleviate your discomfort:

1. Try low impact exercises to strengthen the muscles in your knees. Of course, you will have to consult your doctor before you try any of the exercises at this time.
2. Wear well-cushioned shoes. Padded shoes absorb shock and protect your knees as well.
3. Sit with your feet propped up, this will give immediate pain relief as the weight is off your legs
4. Look for a knee brace. These things support your ligaments and tendons, especially if you have swollen knees during pregnancy
5. Make sure you are not overeating and gaining weight unnecessarily. It is normal to put on 35 pounds in pregnancy.
6. Stick to a good diet and do not over-indulge during your cravings. Stick to a healthy diet to control your weight. This is the best way to prevent knee pain during pregnancy
7. Ask your doctor if you can take small doses of acetaminophen during pregnancy
8. Massage therapy can help joint pain and stiffness

9. Splints may be used, particularly in the hands and feet to provide relief

You can do very little to prevent natural knee pain during pregnancy, until and unless the pain is due to an injury. Here are some things you can do to try and prevent it:

- You can try hot or cold packs to ease the pain from sore joints.
- Always consult with a doctor before taking over-the-counter medication. Doctors usually allow acetaminophen for analgesia during pregnancy.
- Some herbal supplements can be used to prevent joint pain after a doctor consultation
- Include foods rich in Omega-3 in your diet to prevent joint pain
- Take adequate rest to give your knees and joints a break

MATERIALS AND METHODS

Volunteers 22 pregnant (average age: 30.4 years, average BMI before pregnancy: 22.5, during the study 27.3) and 18 nonpregnant women (average age: 33.3 years, average BMI: 21.4). The pregnant women regularly visited the Vol. 1, no. 1, 29-32 (2009).

oral contraceptives Statistical analysis 3-way ANOVA, Bonferroni test (SigmaStat), Fourier analysis (Statistica).

RESULTS

The KT-2000 arthrometer measured significant differences between the elongations of ACL in the pregnant and control groups. ($p < 0.05$).

There was a significant difference between the elongations of the right and left side in both groups ($p < 0.05$). The non -pregnant group sensed significantly better the joint positions with the dominant leg ($p < 0.05$).

There was a significant difference between the dominant and non-dominant leg during pregnancy ($p < 0.05$).

With open eyes the pregnant women had significantly less total sway, with closed eyes there was no significant difference.

During the second part of the pregnancy, this difference is higher. Splitting the sway path into AP and lateral axes in the pregnant women with closed eyes there was a significantly greater

instability in the anterior-posterior axis. When the second pregnant group closed their eyes, they showed significantly increased instability in the anterior-posterior axis.

DISCUSSION

According to the results and the well-known fact that pregnant women's knees have increased laxity, we measured weaker joint position sense on the dominant leg.

With their eyes open the pregnant women had significantly less total sway, with their eyes closed there was no significant difference.

Splitting into AP and lateral axes the pregnant women with closed eyes presented a significantly increased instability in the anterior-posterior axis.

By the second half of the pregnancy when women closed their eyes there was a significantly increased instability in the anterior-posterior axis.

The increased weakness of the knee and the weaker proprioceptive perception to the anterior-posterior Department of Obstetrics and Gynaecology of the Medical University in Szeged. They volunteered for the study after a personal interview. The non-pregnant group was selected from the employees of the Department of Orthopaedics. In both groups there was no professional sports activity, the pregnant women took part in normal prenatal exercising, the non-pregnant women did not take oral contraceptives.

The dominant leg was decided with the ball kicking test.

In all cases the right leg was dominant. The pregnant women were experiencing a normal pregnancy between the 13th and 40th week. We registered the actual state of the pregnancy from their medical records. We divided the pregnant women into two groups (1. 13-28th week; 2. 28-40th week).

Measuring ACL stiffness, we performed KT2000 (Medmetrics Corp, San Diego, CA, USA) arthrometry (three times 15,20,30 pounds forces and maximal femoral-tibial displacements while the knee was placed in 30° of flexion as the subject lay supine on a bench.) We recorded the anterior-posterior displacements in millimeters. All measurements were completed by the same person.

Measuring proprioception Stabilometry Active and passive balance control with opened and closed eyes, detected sway path, splatted into anterior-posterior and lateral axes. The stadiometer (ZWE PII, Hungary) was connected to a computer, the participants made different balance-exercises with the help of the figures on the display:

1. Standing normally, fixing one point on the wall (20s)
2. Standing with eyes closed (20s)
3. Holding a square-figure in the center of the screen (20s)
4. Moving a figure (mouse) to given locations (candies on a Christmas tree) within 20s
5. Moving and holding the figure in a point (within 20s)
6. Putting a pencil figure in a square (within 20s)

The computer analyzed the data using the Fourier analysis.

Joint position sense. We analyzed knee joint kinaesthesia during 30°, 60°, 90° knee flexion, as the patient lay supine on a bench. We measured the differences between the sensed and real knee position 3 times. We registered the positions with a goniometer.

Exclusion criteria Operated knee, knee instability, former pregnancy, T. BÁNYAI ET AL.

Journal of Orthopedics direction may explain the higher injury risk of the anterior cruciate ligament. It could be advantageous to give more specific advice for body training during pregnancy. Some kinds of movements composed of more anterior-posterior kinetic components (stairs) can be riskier. During the second half of the pregnancy, the hormonal influence is increased, the risk of injury is higher and more attention is needed.

We shall perform further studies (the effects of oral contraceptives) to clarify the hormonal influence as a risk factor for injury during female sport activity.

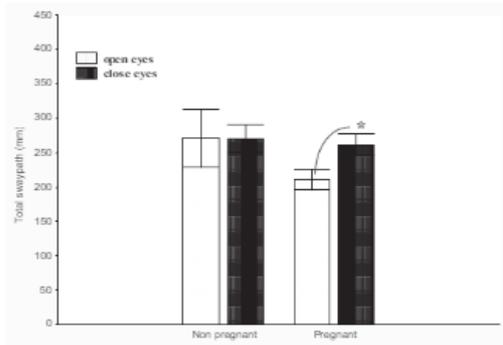


Fig. 1. The sway path differences between pregnant and non pregnant women during stabilometry.

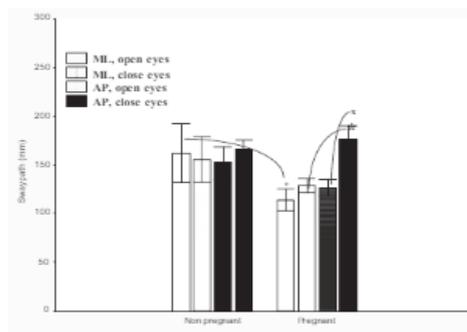
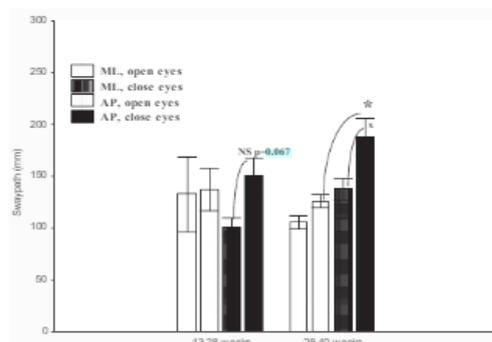
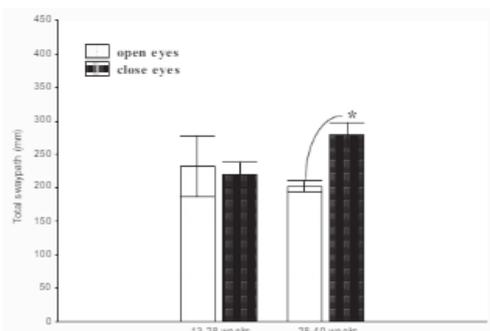


Fig. 3. Sway path differences splitted into antero-posterior and lateral directions. (x, *, +: significant differences)



REFERENCES

1. Wojtys EM, Huston LJ, Boynton MD, Spindler KP, Lindenfeld TN. The effect of the menstrual cycle on anterior cruciate ligament injuries in women as determined by hormone levels. *Am J Sports Med.*, 2002; 30(2): 182-188.
2. Aydog ST, Hascelik Z, Demirel HA, Tetik O, Aydog E, Doral MN. The effects of menstrual cycle on the knee joint position sense: preliminary study. *Knee Surg Sports Traumatol Arthrosc*, 2005; 13(8): 649-53.
3. Braun SV, Beynon BD, Johnson RJ, Sargent ME, Bernstein IM. Serum hormone levels at the time of ACL injury. *DAACL Study Group March 2002.*
4. Liu SH, Al-Shaikh RA, Panossian V. Primary immunolocalization of estrogen and progesterone target cells in the human ACL. *J Orthop Res.*, 1996; 14: 526-33.
5. Yu WD, Panossian V, Hatch JD, Liu SH, Finerman GA. Combined effects of estrogen and progesterone on the anterior cruciate ligament. *Clin Orthop*, 2001; 383: 268–81.
6. Slauterbeck JR, Fuzie SF, Smith MP, Clark RJ, Xu K, Starch DW, Hardy DM. The menstrual cycle, sex hormones, and anterior cruciate ligament injury. *J Athl Train*, 2002; 37: 27.

7. Slauterbeck JR, Pankratz K, Xu KT, Bozeman SC, Hardy DM. Canine ovariectomy and orchiectomy increase the prevalence of ACL injury. *Clin Orthop Relat Res.*, 2004; 429: 301–5.
8. T. Bányai, G. Cerulli, M. Lorenzini, A. Liti, A. Archuleta. Effects of female's hormonal changes on joint laxity, neuromuscular balance during the menstrual cycle. 9th International Conference in Orthopaedics, Biomechanics, and Sports Rehabilitation, Assisi, Abstract Volume, 2005; 278-9.
9. Beynon BD, Bernstein IM, Belisle A, Brattbakk B, Devanny P, Risinger R, Durant D. The effect of estradiol and progesterone on knee and ankle joint laxity. *Am J Sports Med*, 2005; 33: 1298-304.
10. Carcia CR, Shultz SJ, Granata KP, Gansneder BM, Perrin DH. Knee ligament behavior following a controlled loading protocol does not differ by menstrual cycle day. *Clin Biomech (Bristol, Avon)*, 2004; 19: 1048–54.
11. Eiling E, Bryant CAL, Petersen CW, Murphy CA, Hohmann CE. Effects of menstrual-cycle hormone fluctuations on musculotendinous stiffness and knee joint laxity. *Knee Surg Sports Traumatol Arthrosc*, 2007; 15: 126–32.
12. Janse de Jonge XA, Boot CR, Thom JM, Ruell PA, Thompson MW. The influence of menstrual cycle phase on skeletal muscle contractile characteristics in humans. *J Physiol*, 2001; 530(Pt 1): 161-6.
13. Fridén C. Neuromuscular performance and balance during the menstrual cycle. 8th International Conference of Orthopaedics, Biomechanics, Sport's Rehabilitation, 2004.
14. Fridén C, Hirschberg AL, Saartok T, Backstrom T, Leanderson J, Renstrom P. The influence of premenstrual symptoms on postural balance and kinaesthesia during the menstrual cycle. *Gynecol Endocrinol*, 2003; 17(6): 433-9.