EFFECT OF INTRA-ARTICULAR LIDOCAIN INJECTIONS ON IMPACT ATTENUATION DURING WALKING IN KNEE JOINT OSTEOARTHRITIS PATIENTS

[1] Marius Henriksen [2]Erik B. Simonsen [1]Hans Lund [3]Thomas Graven-Nielsen [1]Henning Bliddal [1]Bente Danneskiold-Samsøe
[1]The Parker Institute, Frederiksberg Hospital, Denmark; email: marius.henriksen@fh.hosp.dk
[2]Insitute of Medical Anatomy, University of Copenhagen. [3]Center for Sensory-Motor Interaction, University of Aalborg.

INTRODUCTION

Impulsive loading of the knee joint caused by heel strike has been suggested to participate in the development and progression of degenerative joint diseases, such as osteoarthritis (OA) [1,2].

Joint pain is one of the cardinal symptoms of OA and is one of the primary aims in conservative treatment of the disease. As pain can be considered a protective mechanism, pain relief may have the potential to increase the impulsive knee joint loads during walking and thus accelerate the degeneration through increased mechanical loads.

Accordingly, the aim of the study was to investigate the effect of local knee joint analgesia on the impulsive knee joint loads during walking in patients suffering from knee joint OA.

METHODS

Ten subjects with painful knee joint OA were included in the study (average age 67.8 (SD 5.0), height 164.2 (SD 4.5), weight 74.0 (SD 12.3)).

Intra-articular lidocain injections (10 cc) were performed using ultrasound guidance to ensure proper placement of the bolus within the joint cavity. The injection was performed in the most affected/painful knee.

Linear accelerations were measured at the tibial tuberosity and sacrum, using a piezoresistent accelerometer, in synchrony with a 3D gait analysis. Acceleration measurements and gait analyses were performed before and immediately after the injections. The subjects were instructed and trained to walk at 4.0 km/h (~1.1 m/s) both pre- and post injection.

Knee joint pain during walking was scored using a 100 mm Visual Analogue Scale after the initial measurements (before injections) and again after the post injection measurements.

Impact attenuation (IA) was quantified using a ratio between the peak accelerations at heel strike measured at the tibia tuberosity (P_{tibia}) and sacrum (P_{sacrum}):

$$IA = P_{tibia} / P_{sacrum}$$

To explain the any changes in acceleration patterns kinematic data were extracted from the 3D gait analysis.

RESULTS

One subject was excluded due to misplacement of the lidocain bolus. All remaining subjects showed a significant decrease in pain during walking (p=0.005, see table).

Impact attenuation significantly decreased after lidocain injections (p=0.01), caused primarily by a decrease in tibial accelerations (p=0.002). Sagittal joint kinematics showed a more extended leg after injections. Both hip and knee joint angles at initial contact turned toward extension after injections (p=0.03 and p=0.0005 resp.). Vertical velocity of the shank prior to impact decreased significantly (p=0.02).

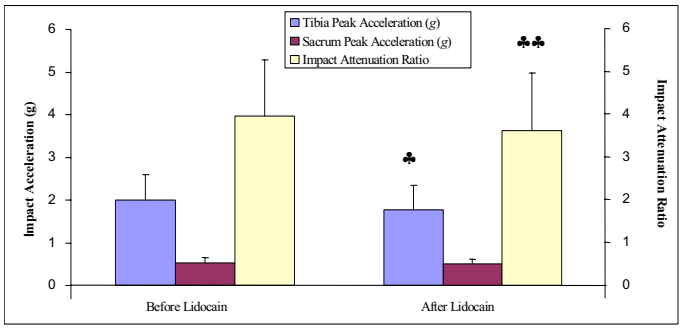

Figure: Peak accelerations (*g*) and impact attenuation ratios before and after lidocain injections. Significant reductions in tibial accelerations ♣ (p=0.002) and impact attenuation ♣♣ (p=0.01) were found.

DISCUSSION

Pain relief affected impact attenuation in a paradoxical way and caused the impact attenuation during walking to decrease, although the impact acceleration at tibia decreased. Extended hips and knees make the leg functionally longer, which could be a possible explanation of the decreased tibial acceleration. Changing knee joint angle at initial contact into more flexion has proved to be highly effective in regulating impact transmissibility [3]. Our results endorsed this, as both knee and hip joint angles changed significantly together with a decreased vertical shank velocity before impact.

CONCLUSION

Local knee joint analgesia may affect the impact attenuation negatively, and this may have clinical implications on the treatment of knee OA in the future.

REFERENCES

1. Radin EL, et al.. *Annals of Rheum Dis* **34**, 132-133, 1975
2. Folman Y, et al.. *Arch Orthop Trauma Surg* **104**, 363-365, 1986
3. Lafortune MA, et al.. *J Biomech* **29**, 1531-1537, 1996

ACKNOWLEDGEMENTS

The Oak Foundation and Copenhagen Hospital Corporation supported the Study.

Table: Average (SD) pain, impact accelerations, impact attenuation ratio (IA) and joint kinematics.

n = 9	Before lidocain	After lidocain	Difference	Paired t-test
Pain VAS (mm)	37.3 (27.8)	1.8 (2.0)	35.6 (27.4)	0.005
Tibial peak acceleration (g)	2.00 (0.59)	1.76 (0.59)	-0.24 (0.18)	0.002
Sacral peak acceleration (g)	0.56 (0.13)	0.50 (0.11)	-0.02 (0.03)	0.07
Impact attenuation ratio (IA)	3.96 (1.32)	3.62 (1.35)	-0.34 (0.33)	0.01
Initial contact knee angle (deg)	8.4 (4.3)	4.0 (5.0)	-4.5 (2.4)	0.0005
Initial contact hip angle (deg)	26.6 (3.9)	24.3 (6.2)	2.2 (2.9)	0.002
Shank vertical velocity (m/s)	0.20 (0.03)	0.18 (0.03)	0.01 (0.02)	0.02