IL6, FOS, and JUN gene expressions were downregulated, and the M2-macrophage-related CCL18 gene expression was upregulated. These results indicated a shift in gene profiles from M1 to M2 macrophages and downregulated inflammatory pathways. The KEGG pathway results showed downregulated inflammatory pathways, such asTLR signaling pathway, rheumatoid arthritis, TNF signaling pathway, cytokine-cytokine receptor interaction, and NF-kappa B signaling pathway. Real-time PCR determined that genes expressing pro-inflammatory II1B and II6, and M2 macrophage-related ILIRA, IL10, CCL18, and CD206 genes were respectively downregulated and upregulated. Histological findings with hematoxylin and eosin staining showed attenuated synovitis scores and immunofluorescence staining showed a shift from M1 to M2 macrophages. ELISA for SF showed only the concentration of interleukin-1b decreased after HTO. Cartilage fragments were less in the SF at plate removal than during HTO, and cartilage fragments, not humoral factor of SF, were responsible for M1 macrophage polarization and pro-inflammatory II1B and II6 expression in the intra primary human macrophages. Postoperative KOOS positively correlated with the expression of the M2-related genes CCL18 (r=0.40) and CD206 (r=0.36)

Conclusion: Correction of mechanical realignment altered the biological micro-environment of the knee joint. HTO is a joint preservation procedure that improves mechanical loading that changes inflammatory status in the knee joint and alters synovial macrophage polarization from M1 to M2, to a pro-healing phenotype.

Category: Knee - Osteotomy

A Fully Automated Artificial Intelligence for Lower Extremity Alignment Analysis – An Internal Validation Study in a Large Osteotomy Patient Collective

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All Authors:
Marco-Christopher Rupp MD GERMANY
Felix Lindner cand. med. GERMANY
Yannick Ehmann MD GERMANY
Andreas B. Imhof MD, Prof. Emeritus GERMANY
Sebastian Siebenlist MD, MHBA, Prof. GERMANY
Matthias Feucht Prof. GERMANY
Claudio von Schacky MD GERMANY
Nikolas Wilhelm MSc GERMANY

Summary:
The developed artificial intelligence allowed for completely autonomous comprehensive analysis of the leg alignment on long leg radiographs with a high precision and reliability comparable to orthopedic surgeons.

Data:
Background A comprehensive analysis of the leg alignment is paramount for the determination of an evidence-based treatment plan and the preoperative planning across a wide range of knee pathologies. A deep learning (DL) model that performs an automated analysis of the leg alignment on x-rays could accelerate the process currently performed by orthopedic surgeons (OS) and increase accuracy and reliability of preoperative planning. The purpose of this study was to train and validate a DL model for an automated assessment of the leg alignment with a threshold more than the mean signal intensity plus two standard deviations, using the corresponding lateral condyles as controls. BML volumes were then calculated by the integration of BML in each slice. Association between KOOS total/subscores and BML scores/volume was evaluated with Spearman’s correlation. Spearman’s correlation between BML volumes and Lysholm knee and Tegner activity scores were also calculated. Finally, multivariable linear regression analysis for the post-operative KOOS total was performed using a backward-stepwise approach to minimize the Akaike information criterion. Results Forty-three cases (24 females and 19 males, mean age 61.5 ± 7.4 years old) of MOWHTO were included in the final analysis. No significant correlations between qualitative BML scores and pre-operative, post-operative, and delta KOOS were found, except one BML score each which correlated with pre-operative KOOS scores or with post-operative KOOS ADL. Femoral BML volume did not correlate with pre-operative, post-operative or delta- KOOS total, but tibial BML volume weakly correlated with delta KOOS total (r = 0.33, p = 0.03). For KOOS subscales, femoral BML volume were correlated with post-operative KOOS ADL (r = 0.36, p = 0.02) and KOOS QOL (r = 0.50, p = 0.007), and tibial BML volume were correlated with post-operative KOOS ADL sports (r = 0.38, p = 0.01). Tibial BML volume was significantly correlated with all five delta KOOS scales (r = 0.37 to 0.51, p = 0.02 to 0.007), however, femoral BML volume was only correlated with delta KOOS QOL (r = 0.41, p = 0.009). The femoral and tibial BML volumes were moderately (r = 0.42, p = 0.006) and weakly (r = 0.36, p = 0.02) correlated with delta Lysholm knee scores, respectively, while BML volumes did not correlate with Tegner activity scores. Conclusion Larger pre-operative BML volumes positively correlated with some post-operative KOOS subscales and with many delta KOOS subscales. Pre-operative large BML had no negative influence on post-operative clinical outcomes; hence, surgeons need not hesitate to perform MOWHTO in patients with large BMLs in the medial condyles.

Data:
Purpose There is insufficient evidence regarding the indications of MOWHTO in patients with large pre-operative bone marrow lesion (BML). To this end, this study evaluated modern medial open-wedge high tibial osteotomy (MOWHTO) clinical outcomes and bone marrow lesion (BML) scores and volumes. We hypothesized that BML volume is more associated with clinical outcomes of MOWHTO than qualitative BML evaluations, and that BML volume is correlated with the improvement of clinical outcomes. Methods Patients who underwent MOWHTO for osteoarthritis or spontaneous necrosis of the knee between 2018 and 2021 were enrolled retrospectively. Knee Injury and Osteoarthritis Outcome Score (KOOS) was recorded before the initial surgery and at plate removal surgery. Pre-operative BMLs were evaluated using three qualitative scoring systems, reflecting the maximum length, proportion, and intensity of the BML. For quantification, BMLs of the femur and tibia were separately defined as the area with a threshold more than the mean signal intensity plus two standard deviations, using the corresponding lateral condyles as controls. BML volumes were then calculated by the integration of BML in each slice. Association between KOOS total/subscores and BML scores/volume was evaluated with Spearman’s correlation. Spearman’s correlation between BML volumes and Lysholm knee and Tegner activity scores were also calculated. Finally, multivariable linear regression analysis for the post-operative KOOS total was performed using a backward-stepwise approach to minimize the Akaike information criterion.