

# Preventing the development of further osteoarthritis after unilateral knee arthroplasty through training

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## Summary

Deficits in muscle strength and knee kinematics after unilateral knee arthroplasty (uKA) can increase the risk of a second joint replacement [1,2]. Patients with uKA participated in a 12-week training intervention three months after their surgery. The change of COMP (cartilage oligomeric matrix protein), as a blood marker of cartilage turnover, through a hike was measured before and after the training period. The COMP value in the blood serum increased during the hike. This increase of COMP was lower after the training period than before. The more training sessions a participant conducted, the lower was the increase in COMP after the training sessions. The results highlight the potential of training in preventing the development of further osteoarthritis after uKA.

## Introduction

A stiff knee gait pattern and reduced quadriceps and hamstring strengths after uKA can lead to overloading of the contralateral joint and increases the risk of a second joint replacement within the next 5 years [1,2]. We hypothesized that a 12-week training intervention elevates muscle force of quadriceps and hamstrings muscles and counteracts deficits in knee kinematics during hiking. We further hypothesized that these factors influence the expression of a blood marker for cartilage turnover (COMP).

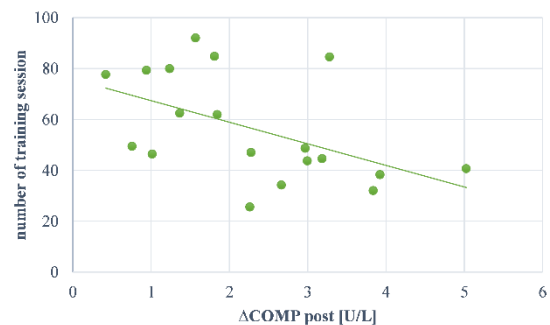
## Methods

Twenty persons with uKA ( $259 \pm 97$  days post-surgery) participated in a 12-week training intervention. During the training period, 36 sessions of functional strength training were offered by the conductor of the study. Additional self-organized training sessions were recorded by the participants of the study in a training diary. Before (pre) and after (post) the training period the maximal isometric strength of the quadriceps and hamstrings muscles were measured (IsoMed 2000, D. & R. Ferstl GmbH, Hemau, Germany). Furthermore, the participants conducted a hike of 4.11 km length and 200 meters of height with gradients up to 25 %. Knee kinematics were recorded at different uphill and downhill slopes (MVN Awinda, XSens, Enschede, Netherlands). Before and after the hike blood samples were taken for the analysis of COMP protein (COMP Elisa, IDS, Boldon, UK).

## Results and Discussion

Patients conducted  $33.4 \pm 9.1$  guided training sessions and  $56.5 \pm 20.6$  extra self-organized training sessions within the

12 weeks. The COMP value in the blood serum increased in people with uKA during the hike. This increase of COMP was lower after the training period ( $\Delta\text{COMP}$  post  $2.2 \text{ U/L} \pm 1.3 \text{ U/L}$ ) than before ( $\Delta\text{COMP}$  pre  $2.9 \text{ U/L} \pm 0.8 \text{ U/L}$ ,  $p < 0.05$ ). The increase of COMP post through the hike did not correlate with parameters of knee kinematics at any slope (maximal knee flexion and maximal knee range of motion during stance) and muscle strength improvements (maximal concentric and eccentric quadriceps and hamstrings strength, Nm/kg,  $p > 0.05$ ). However, the more training sessions a participant conducted, the lower was the increase in COMP after the training sessions ( $\Delta\text{COMP}$  post, Pearson's  $r = -0.51$ ,  $p < 0.05$ , Fig. 1). In addition, the differences in  $\Delta\text{COMP}$  ( $\Delta\text{COMP}$  pre –  $\Delta\text{COMP}$  post) correlated positively with the number of training sessions with Pearson's  $r = 0.56$  ( $p < 0.05$ ). The more training sessions a participant conducted, the greater was the difference between the increase of COMP by the hike between pre training and post training.



**Figure 1:** Correlation matrix of  $\Delta\text{COMP}$  post and total number of conducted trainings sessions during a 12-week period.

## Conclusions

The reduced increase of COMP after a training period was not related to the development in muscle strength or knee kinematics during a hike, but correlated with the amount of training sessions. The results highlight the potential of training in preventing the development of further osteoarthritis after uKA.

## Acknowledgments

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## References

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