

# Genu Arthro

## EMG

### Major Findings

With Genu Arthro:

#### → Muscle activity of rectus femoris (RF), lateral gastrocnemius (GL) and lateral hamstring (LH) decreased

Pre-activation phase:	RF with neutral adjustment:	13.6% decrease
Loading phase:	GL with 4° valgus adjustment:	23.8% decrease
Early stance phase:	GL with neutral adjustment:	16% decrease
	GL with 4° valgus adjustment:	17.7% decrease
Late stance phase:	RF with neutral adjustment:	18.5% decrease
	RF with 4° valgus adjustment:	16.3% decrease
	LH with neutral adjustment:	35.8% decrease
	LH with 4° valgus adjustment:	31.3% decrease

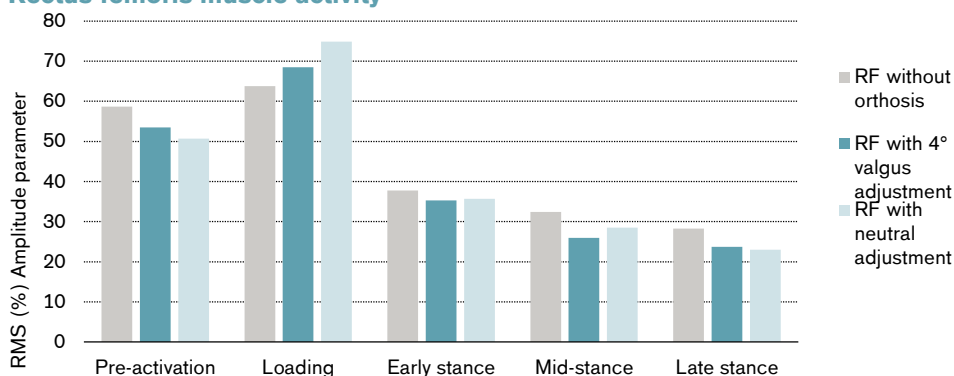
#### → Co-contraction ratios of the medial/lateral (M/L), flexor/extensor (F/E) muscle groups decreased

Loading phase:	F/E with 4° valgus adjustment:	15.1% decrease
Late stance:	M/L with 4° valgus adjustment:	12.3% decrease
	F/E with 4° valgus adjustment:	21.5% decrease

#### → Co-contraction ratios of the lateral vastus/lateral gastrocnemius (VL/GL), lateral vastus/lateral hamstring (VL/LH) and medial vastus/medial hamstring (VM/MH) muscle pairs decreased

Pre-activation phase:	VL/LH with neutral adjustment:	16.8% decrease
	VL/LH with 4° valgus adjustment:	5.9% decrease
	VM/MH with neutral adjustment:	19.6% decrease
	VM/MH with 4° valgus adjustment:	10.4% decrease
Loading phase:	VL/GL with 4° valgus adjustment:	28.4% decrease

### Rectus femoris muscle activity



### Clinical Relevance

Knee osteoarthritis (OA) is a degenerative disease characterised by irreversible joint damage including cartilage loss and changes in bone and joint capsule (Felson, 2004). To counteract joint instability, increase in the muscle activity and co-contraction of agonist and antagonist muscles have been observed in OA patients and associated to a strategy used to stabilise the joint (Heiden et al., 2009; Childs et al., 2004; Lewek et al., 2005; Hortobágyi et al., 2005). Therefore, knee braces may possibly reduce knee loading by decreasing muscle activation and co-contraction levels.

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## Summary

Muscle activity and co-contraction ratios were measured for 4 phases of the gait (Pre-activation, loading, early stance and late stance phase). The difference of the 2 orthosis adjustments (4° valgus and neutral) are compared to the condition without orthosis.

A significant muscle activity decrease was reported for rectus femoris (up to 18.5%), gastrocnemius lateralis (up to 23.8%) and lateral hamstring (up to 35.8%) at minimum in one of the four walking phases.

Regarding the Co-contractions ratios of the loading and late stance phase, significant decreases of 15.1% and 21.5% for the flexor/extensor muscle groups were reported with the valgus adjustment. Additionally, a reduction of the medial/lateral muscle group activation by 12.3% (4° valgus) was observed during late stance phase.

For the pre-activation phase, decreases of the co-contractions ratios up to 19.6% were reported for 2 muscle pairs. During loading phase, reductions for the lateral vastus /lateral gastrocnemius were observed (28.4% with 4° valgus).

Significant decreases in muscle activity and co-contraction ratios were observed with the use of the knee brace in both adjustments, due to a mechanical stabilization of the knee by the brace. (Fantini Pagani, 2013)

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## References of summarized studies

Fantini Pagani CH, Willwacher S, Kleis B, Brüggemann G-P (2013). Influence of a valgus knee brace on muscle activation and co-contraction in patients with medial knee osteoarthritis. *J Electromyogr Kinesiol*; 23(2):490-500.

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## Other References

Childs JD, Sparto PJ, Fitzgerald GK, et al (2004). Alterations in lower extremity movement and muscle activation patterns in individuals with knee osteoarthritis. *Clin Biomech*;9:44–9.

Felson DT (2004). Risk factors for osteoarthritis: understanding joint vulnerability. *Clin Orthop Relat Res*:S16–21.

Heiden TL, Lloyd DG, Ackland TR (2009). Knee joint kinematics, kinetics and muscle co-contraction in knee osteoarthritis patient gait. *Clin Biomech*;24:833–41.

Hortobágyi T, Westerkamp L, Beam S, et al (2005). Altered hamstring-quadriceps muscle balance in patients with knee osteoarthritis. *Clin Biomech*;20:97–104.

Lewek MD, Ramsey DK, Snyder-Mackler L, et al (2005). Knee stabilization in patients with medial compartment knee osteoarthritis. *Arthritis Rheum*;52:2845–53.

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