Reference

Fantini Pagani CH, Willwacher S, Kleis B, Brüggemann G-P.

Institute of Biomechanics and Orthopaedics, German Sport University Cologne, Germany.

Influence of a valgus knee brace on muscle activation and co-contraction in patients with medial knee osteoarthritis

J Electromyogr Kinesiol 2013; 23(2):490-500.

Products

Genu Arthro

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

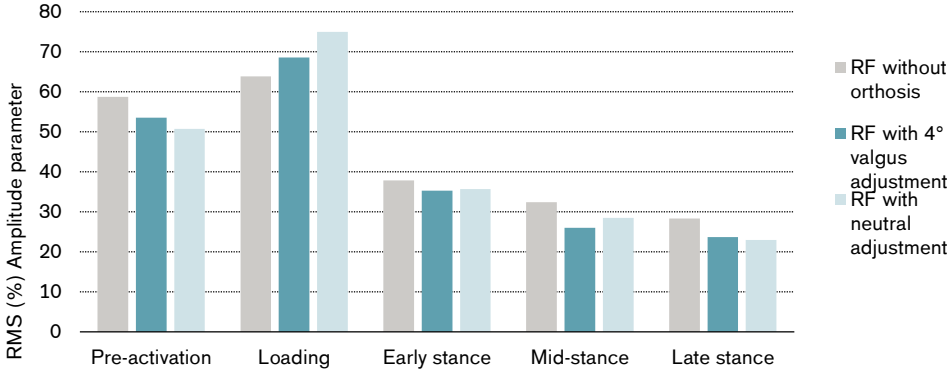
→ Co-contraction ratios of the medial/lateral (M/L), flexor/extensor (F/E) muscle groups decreased

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) , lateralvastus/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

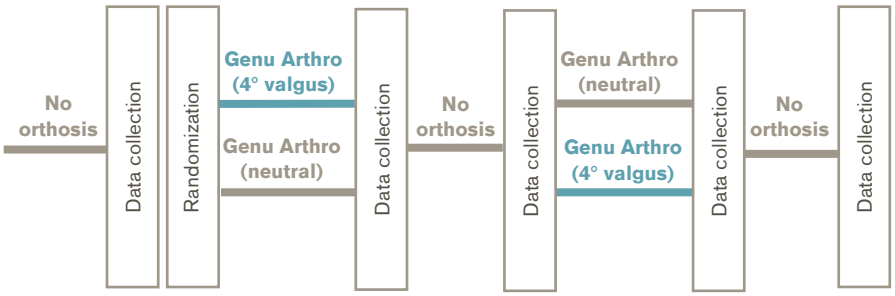


Population

Subjects:	12 patients (7 female, 5 male)
Mean age:	56.0 ± 4.6 yrs
Mean body mass:	80.9 ± 13 kg
Inclusion criteria:	medial knee osteoarthritis from grade II to IV

Study Design

Observational, comparative:



The patients were not informed about the different adjustments of the orthosis.

Results

Functions and Activities						Participation
Biomechanics – Static measures	Biomechanics – Gait analysis	X-Ray	EMG	Functional tests	Clinical effects	Satisfaction

Category	Outcomes	Results for Genu Arthro	Sig.*
EMG	Amplitude parameters – Quadriceps group	**In the pre-activation phase of the gait cycle the muscle activity of the rectus femoris decreased by 13.6% with the neutral adjustment.**	++
		In the late stance phase the muscle activity of the rectus femoris decreased by 16.3% with the 4° valgus and by 18.5% with the neutral adjustment. In all other phases of the gait cycle no significant changes were found for the rectus femoris, vastus lateralis and vastus medialis.	++
	Amplitude parameters – Hamstrings group	**The muscle activity of the lateral hamstring was significantly lower with the 4° valgus (31.1%) and the neutral adjustment (35.8%) in the late stance phase.** The muscle activity in the other phases of the gait cycle and of the medial hamstring did not differ significantly.	++
	Amplitude parameters – Gastrocnemii group	**The muscle activity of the lateral gastrocnemius was significantly lower in the loading phase with the 4° valgus adjustment (23.8%). In the early stance phase the 4° valgus (17.7%) and the neutral adjustment (16%) led to decreased muscle activity of the lateral gastrocnemius.**	++

Category	Outcomes	Results for Genu Arthro	Sig.*
		The muscle activity in the other phases of the gait cycle and of the medial gastrocnemius did not differ significantly.	
	Co-contraction ratios *Medial/lateral*	**The co-contraction ratios were 12.3% lower with the 4° valgus adjustment in the late stance phase.** Inter individual differences: 4° Valgus vs without orthosis: 83%*: decrease; 17%: increase Neutral vs without orthosis: 50%: decrease; 17%: no change; 33%: increase *of patients	++
	Co-contraction ratios *Flexors/extensors*	**The co-contraction ratios were 15.1% lower in the loading phase and 21.5% lower in the late stance phase with the 4° valgus adjustment.** Inter individual difference was high.	++
	Co-contraction ratios (late stance phase) *Muscle pairs*	*Loading phase:* **Lateral Vastus / lateral gastrocnemius: 28.4% decrease (4° valgus)**	++
		Pre-activation phase: **Lateral Vastus / lateral hamstring: 5.9% (4° valgus) and 16.8% (neutral) decrease** **Medial Vastus / medial hamstring: 10.4% (4° valgus) and 19.6% (neutral) decrease**	++
		No significant differences for medial vastus / medial gastrocnemius and medial hamstring / lateral hamstring.	0
Satisfaction	Questionnaire about comfort, acceptance and subjective changes in gait	Perception of comfort during rest or gait did not differ significantly between the 4° valgus and neutral condition nor the perception of changes in gait and acceptance as treatment option.	0

* no difference (0), positive trend (+), negative trend (–), significant (++/––), not applicable (n.a.)

Author's Conclusion

"In summary, significant decreases in muscle activity and co-contraction ratios were observed with the use of the knee brace in both adjustments, indicating a mechanical stabilization of the knee by the brace. The results of our study support the theory of a possible beneficial effect of knee braces in reducing knee loading by decreasing muscle activation and co-contraction levels. This additional mechanism of loading reduction in conjunction with the load reduction induced by the three-point-bending system of valgus braces could further contribute to avoid disease progression in patients with knee osteoarthritis." (Fantini Pagani et al. 2012)