Reference	Engel K, Brüggemann G-P, Heinrich K, Potthast W, Liebau C.							
	Institute of Biomechanics and Orthopedics, German Sport University Cologne, Ar Sportpark Müngersdorf 6, 50933 Cologne, Germany. Do counteracting external frontal plane moment alter the intraarticular contact force distribution in the loaded human tibiofemoral joint?							
	Products	Genu Arthro						
Major Findings	With Genu Arthro: → A higher knee flexion, leads to an increase of the medial compartment loading (varus and valgus alignment)							
								→ Counteracting abduction moments have a higher positive influence on th force in the medial knee joint compartment than adduction moments for the lateral compartment.
	→ The same level of counteracting moment in much higher shift of the COP than in varus							
	Average of medio-lateral force ra							
	counteracting frontal p	plane moments						
	. <u>9</u> 2,5	L						
	2,5 2,5 1,5 1,5 1,5 1,5 1,5 1,5 1,5 1							
	≚ 0,5							
	0							
	-5 -2.5 0	2.5 5						
	Adduction Abduction							
		Counteracting moments [Nm]						

The applied counteracting abduction moments led to higher redistributions than the applied adduction moments.

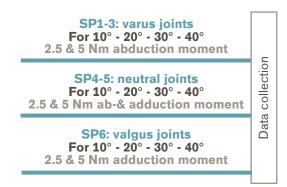
Population

Ex vivo:

6 cadaver legs (4 female, 2 male) (59-101 yrs) SP1-3: varus joint SP4-5: neutral SP6: valgus joint

## **Study Design**

Interventional, comparative:



One cylinder on top of the simulator was used for the up and down movements of the sliding bar. The steel cylinder with the femur was attached to a ball joint fixed to this sliding bar. A predefined range of motion from 10° to 40° flexion of the knee joint was measured on the lateral side of the legs using a goniometer. A reference trial without any applied frontal plane moments was captured of all joints. With Genu Arthro counteracting abduction moments of 2.5 and 5 Nm were applied to the varus joints, adduction moments to the valgus joint, respectively. The neutral aligned joints were tested under all conditions. Each condition was repeated five times. The negative sign indicates applied abduction moments.

Functions and Activities							Partici	Participation	
Biomechanics – B Static measures G	EMG		Functional tests		Clinical effects		Satisfaction		
Category	Outcomes	Results fo	or Genu A	Arthro				Sig.*	
Biomechanics – Static measures	Knee flexion angle	increasing knee flexion angles, the forces in the medial n.a. compartment increase, even for the knee joint aligned in varus							
		Medio-lateral force ratio (>1→med. knee joir					t comp		
		Flexion	SP1	SP2	SP3	SP4	SP5	SP6	
		10°	1.8	5.1	1.5	0.8	1.3	0.2	
		20°	2.1	5.4	1.7	1.8	1.5	0.3	
		30°	2.8	5.9	2.2	2.7	2.2	0.5	
		40°	3.2	6.3	2.5	3.9	3.0	0.6	
	Medio-lateral force-ratio	The joints aligned in varus (SP1–3) and neutral (SP4-5) higher loading in the medial compartment, whereas mor transferred through the lateral compartment in the knee aligned in valgus (SP6). The applied counteracting abduction moments lead to higher redistributions than the applied adduction						load is	
		moments.							
	Shift of the COP (centre of pressure)	The largest COP shift effect of 4.3 mm to the medial side is found in the joint in valgus alignment when a 5 Nm adduction moment is applied. By comparison, the high- est COP shift for the lateral side is 1.8 mm.						n.a.	

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

## Author's Conclusion

"The current study demonstrated that direct intraarticular measurements could be used to study the relationship between knee joint compartment loading and mechanically induced external moments. The presented findings have clinical relevance and offer novel insights to guide development and optimization of mechanical aids for the treatment of the osteoarthritic knees. Future of load redistributing knee orthotics should consider adaptive approaches to apply frontal plane moments dependent on the movement phase since the intraarticular load is related to the knee joint flexion angle." (Engel et al. 2015)

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