

GROUND REACTION FORCES IN NORDIC WALKING AND WALKING

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INTRODUCTION: Nordic Walking as an established endurance sports showed a higher cardiovascular load compared to normal walking caused by the additional use of poles (Butts et al. 1995; Rodgers et al. 1995; Jordan et al. 2001). There is still a lack of knowledge regarding the joint load. A reduction up to 30% based on the use of poles is often described but the evidence is missing. The objective of the given study was to examine the load on lower limbs using biomechanical parameters comparing walking [W] and nordic walking[NW].

METHOD: Twenty volunteers (informed consent) participated in this experimental cross-sectional study. Vertical ground reaction forces were measured during walking and nordic walking using an insole plantar pressure distribution system (Fa. GeBiom, Münster Germany) A measuring frequency of 200 Hz with a resolution up to 64 sensors (depending of insole size) was used. In addition 3 sensors are mounted to the poles during the nordic walking condition. 16 female and 4 male well trained nordic walker (age: 49,7 ±12,0 years; height: 1,69 ±0,09 m; weight: 70,8 ±16,1 kg) were tested in a randomised order on a treadmill (Woodway) at three given walking speeds (5,5 km/h [A]; 6,5 km/h [B] and 7,5 km/h [C]) in walking and nordic walking respectively.

RESULTS: The results showed no significant differences regarding the maximum vertical GRFz (A=1,66(W) and 1,72(NW); B=1,70(W) and 1,71(NW); C:1,73(W) and 1,76(NW) of bodyweight) as well as no significant changes in the initial increase of forces. Contact time is longer for Nordic Walking on each given walking speed ($p < 0.05$). The impulse values are higher for the Nordic walking condition (Tab.1).

Table 1

walking speed	5,5 km/h	6,5 km/h	7,5 km/h	
max. GRFz (N)	1135,3	1162,4	1215,4	walking
	1181,4	1178,2	1242,0	nordic walking
p-value	0,058	0,519	0,541	
impulse (Ns)	409,5	381,2	354,3	walking
	469,6	424,7	376,9	nordic walking
p-value	0,000	0,000	0,021	
contact time(s)	0,56	0,53	0,48	walking
	0,63	0,57	0,51	nordic walking
p-value	0,000	0,000	0,042	

DISCUSSION / CONCLUSION: In opposition to the frequently stated reduction of lower limb loading by the use of walking poles, the given results showed no reduction in all measured parameters. Longer contact time as well as higher impulse values compared to the walking condition indicated a more dynamic movement in nordic walking. This leads finally to a higher cardiovascular and metabolic load in contrast to walking. The recommendation of Nordic walking as a rehabilitation training concept for orthopaedic patients should be considered again (Brunelle et al 1998).

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