GROUND REACTION FORCE AND CENTRE OF PRESSURE IN ALPINE SKIING CARVED TURN

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INTRODUCTION

The carving turn is the basic move of the modern alpine skiing technique. It can be identified by the skier's open position, which allows effective use of the knee joints. The more weight skier transfer to one or both skis, the better he/she grips during the turn. The purpose of this study was to determine the force level and area of the centre of pressure under the feet during carved turn among male alpine skiers.

METHODS

Three male Finnish national alpine team skiers were subjects in this study. They made four runs on a symmetric steep course with ten turns. The ground reaction forces (GRF) in the ski boots were measured by Paromed insoles, embedded with 24 pressure sensors in each, at the frequency of 200 Hz. All runs were video recorded. Five clean carved turns to the right and left from each subject were chosen for analyze according to the video recording and foot pressure curves. In this study the rise of outer foot force curve was the starting point and the descent back to the baseline the end point of the turn. Each sensors signal was filtered by 5 points moving average. The GRF and the centre of pressures (CofP) were calculated from the pressure distribution data.

RESULTS & DISCUSSION

Measured parameters values are shown in Table 1. In the figure 1 there is an example of one skier's outer foot path of the CofP and force curve during one turn.

Table 1. *Measured parameters and differences (ANOVA; * = p<.05).*

	Foot	Time	Max GRF	Max GRF	Mean GRF	CofP
		s	s	N	N	cm²
Skier A	Outer	0.76±.09	0.39 ± 0.16	1322 ± 157	752 ± 144	8.5 ± 0.5*
	Inner		0.45 ± 0.13	987 ± 186	578 ± 117	4.9 ± 0.7^{vsC*}
Skier B	Outer	0.74±.08	0.42 ± 0.11	1386 ± 173	747 ± 124	23.0 ± 7.6*
	Inner		0.44 ± 0.12	989 ± 225	567 ± 152	8.4 ± 0.6
Skier C	Outer	0.81±.11	0.45 ± 0.10	1677 ± 216*	947 ± 184*	14.5 ± 2.8*
	Inner		0.46 ± 0.16	1248 ± 224*	586 ± 133	10.4 ± 2.9^{vsA*}

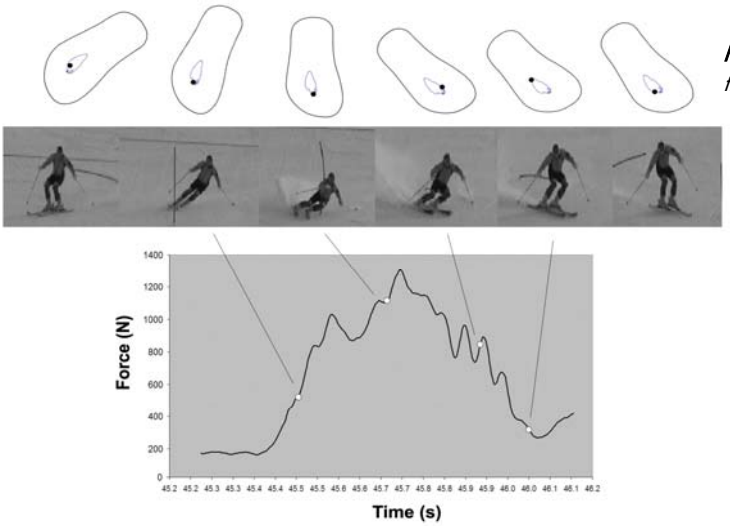

Figure 1. *One skier's outer foot path of the CofP and force curve during one turn.*

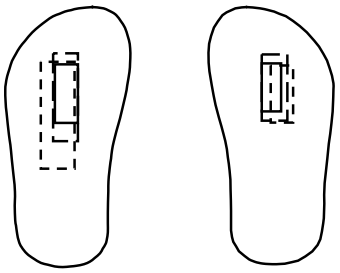

Figure 2. *Average CofP movement areas. Skier A –, skier B – – and skier C – –. All values converted to the right turn.*

Although the turn's timing parameters were the same, there were some differences in the GRF and CofP movement areas between the subjects. The measured GRF values were in line with the other studies [1,2,3]. Compared to the skidded turn [3], the CofP travels in much smaller area in the carved turn (fig 2).

CONCLUSION

During the carved turn skier had to produce both high brief maximal and long lasting adequate force level. The CofP travels under the metatarsal 2-4 bones. In these ways the skier controls the skis bending and contact with the snow along the whole length of the ski edge.

REFERENCES

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