

2009 Berlin, motion analysis for disqualification

Analysed athletes

- Disqualified Athlete
- Athletes who received one or two red cards and walked in the same group with disqualified Athlete.

M50kmW

DQ-A vs Kirdyapkin (RUS, 1st), Adams (Aus, 6th)

DQ-B vs Höhne (GER, 5th), Tóth (SVK, 10th)

* Winner of M20kmW , Borchin (RUS) was also analysed.

W20kmW

DQ-C vs Loughnane (IRL, 2nd), Santos (POR, 5th)

* Winner of W20kmW, Kaniskina (RUS) was also analysed.

Step Analysis - 1

	M50kmW Leading group			*M20kmW 1 st
	DQ-A	Kirdyapkin (RUS)	Adams (AUS)	Borchin (RUS)
Red card	<~~	~	<	-
Analysed distance	11.5km	11.5km	11.5km	17.5km
Walking speed (m/sec)	3.92	3.94	3.93	4.46
Step frequency (steps/sec)	3.33	3.24	3.24	3.43
Support time (sec)	0.275	0.292	0.292	0.267
Flight time (sec)	0.025	0.017	0.017	0.025
Step length (m)	1.17	1.21	1.21	1.30
Support distance (m)	1.07	1.14	1.14	1.18
Flight distance (m)	0.10	0.07	0.07	0.11

** Fligh time of DQ-A was not much longer than other walker
In 20km, there were qualified walkers who had longer flight time*

Step Analysis - 2

	M50kmW Second group			*M20kmW 1 st
	DQ-B	Höhne (GER)	Tóth (SVK)	Borchin (RUS)
Red card	~~~	~~	~~	-
Analysed distance	11.5km	9.5km	9.5km	17.5km
Walking speed (m/sec)	3.75	3.77	3.94	4.46
Step frequency (steps/sec)	3.43	3.33	3.08	3.43
Support time (sec)	0.258	0.300	0.292	0.267
Flight time (sec)	0.033	0.033	0.033	0.025
Step length (m)	1.09	1.25	1.28	1.30
Support distance (m)	0.96	1.13	1.14	1.18
Flight distance (m)	0.13	0.12	0.14	0.11

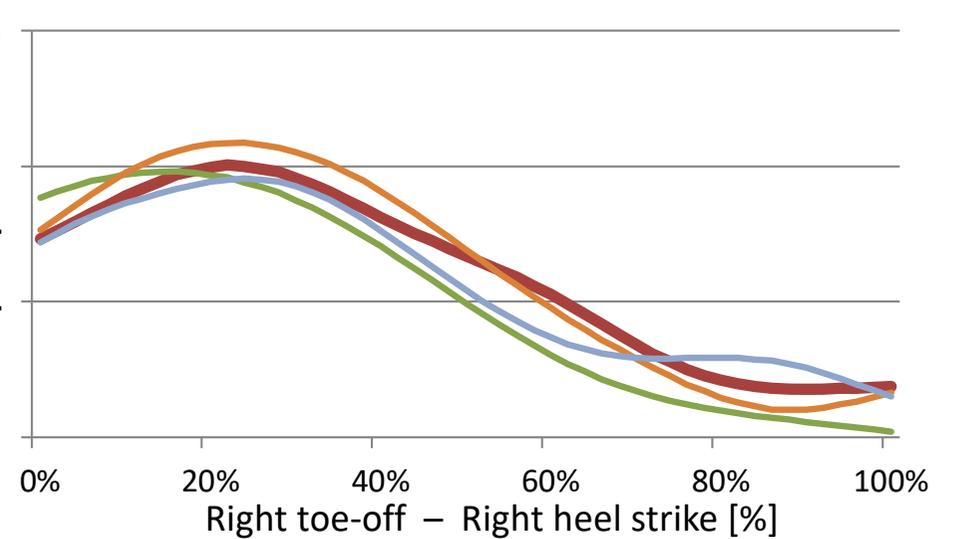
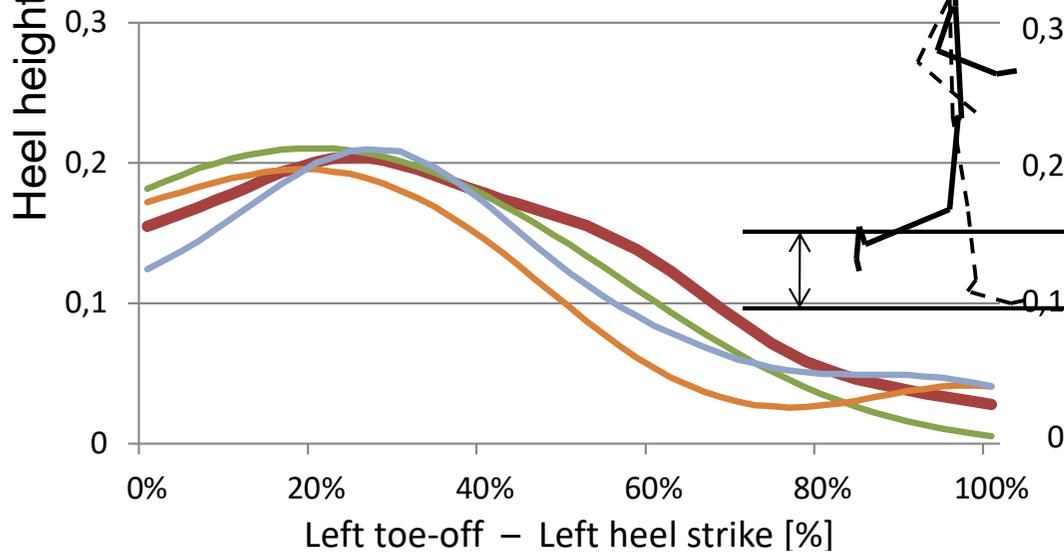
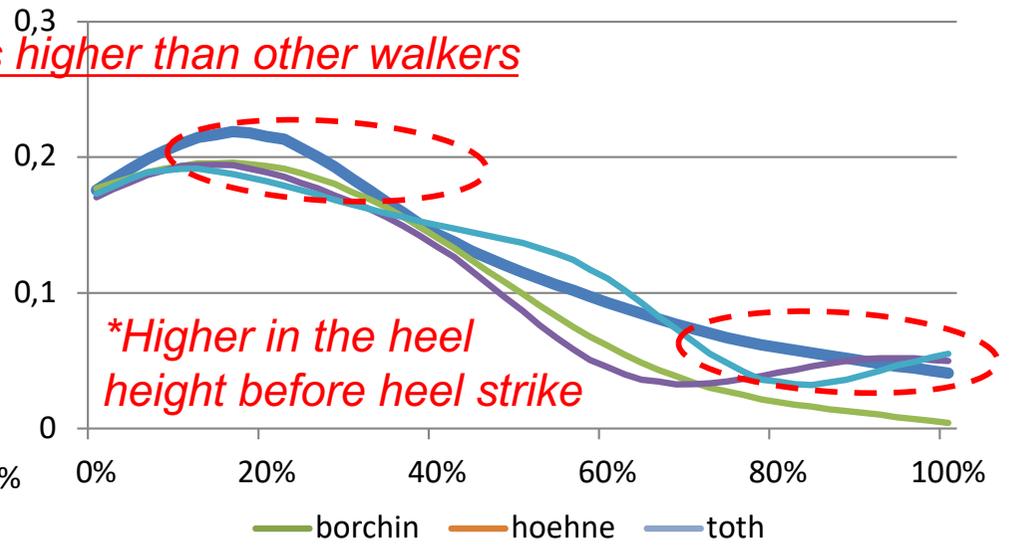
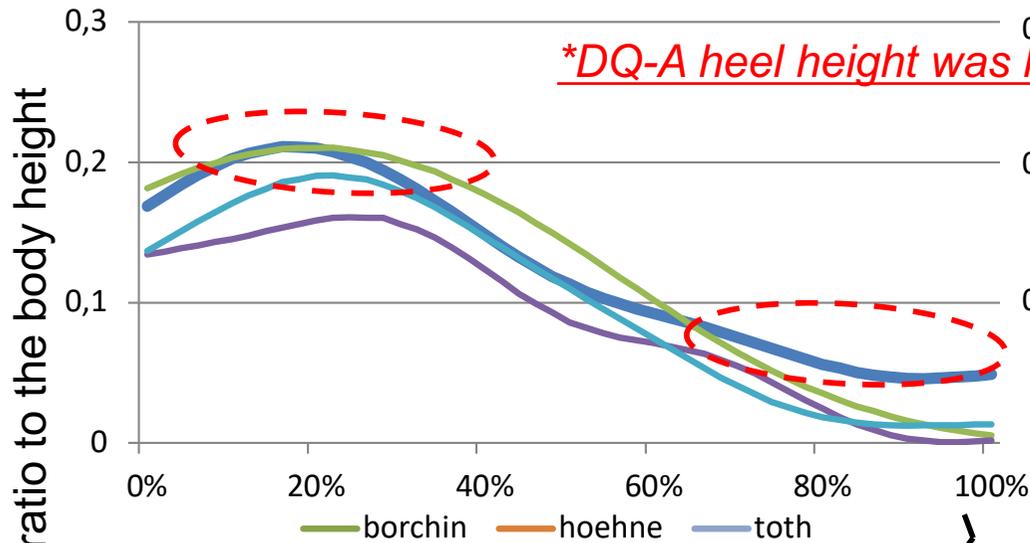
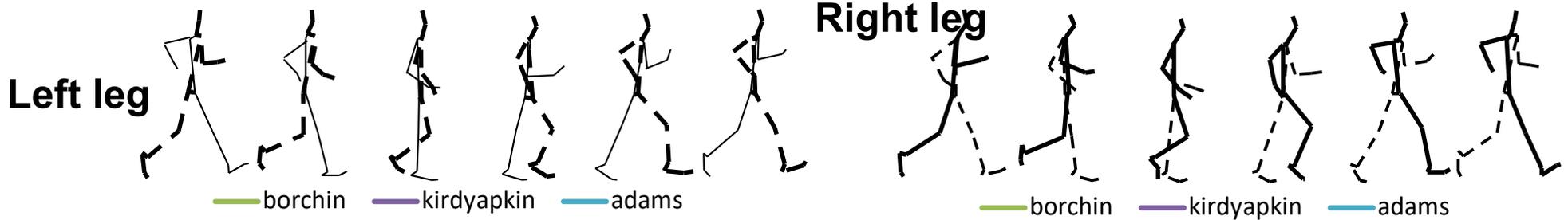
* Flight time of DQ-B was long as other walkers.

Step Analysis - 3

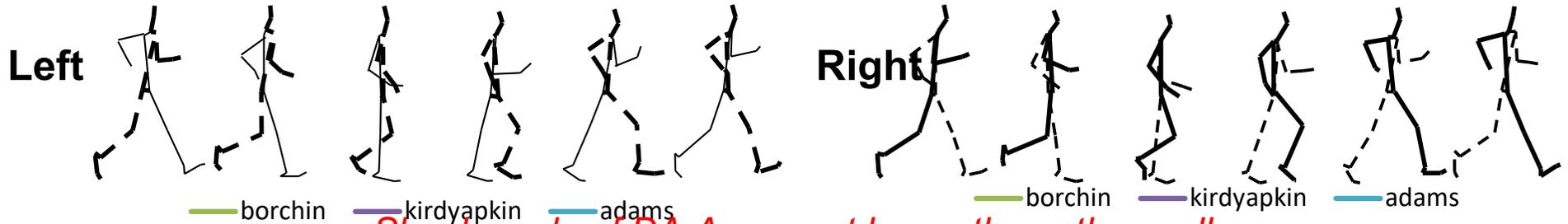
	W20kmW Second group			*W20kmW 1 st
	DQ-C	Loughnane (IRL)	Santos (POR)	Kaniskina (RUS)
Red card	~~~	~	~	-
Analysed distance	7.5km	9.5km	7.5km	7.5km
Walking speed (m/sec)	3.79	3.70	3.80	3.83
Step frequency (steps/sec)	3.33	3.43	3.33	3.43
Support time (sec)	0.267	0.258	0.275	0.267
Flight time (sec)	0.033	0.033	0.025	0.025
Step length (m)	1.14	1.08	1.14	1.12
Support distance (m)	0.01	0.96	1.04	1.02
Flight distance (m)	0.13	0.12	0.10	0.10

* Fligh time of DQ-C was not much longer than other walker
In 20km, there were qualified walkers who had longer flight time

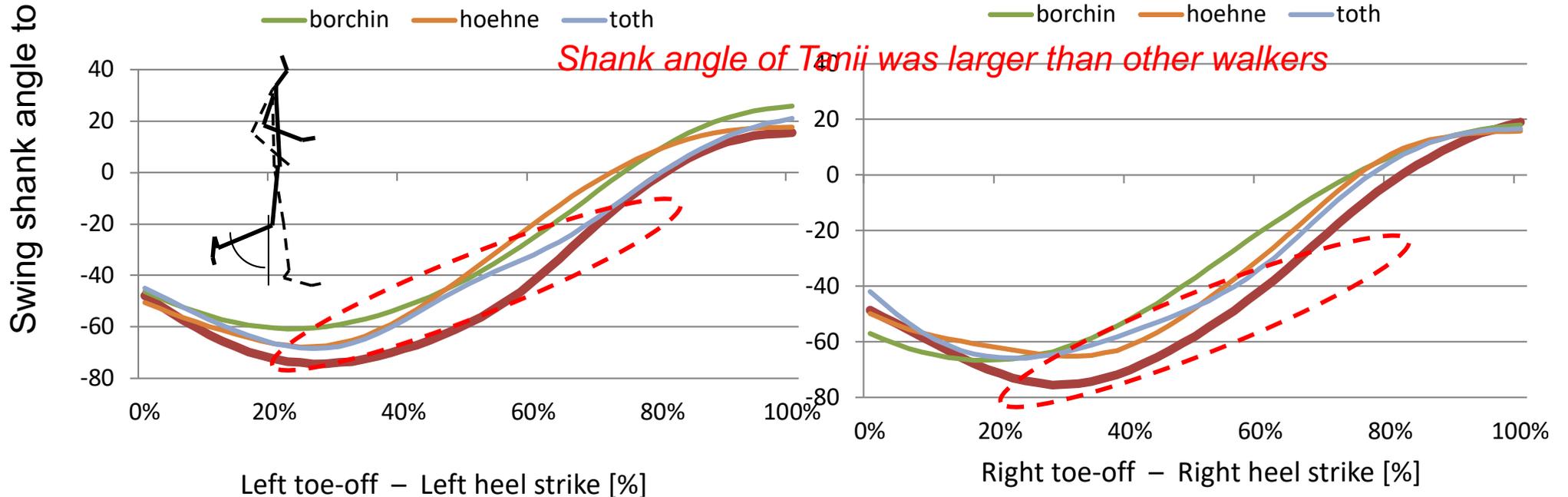
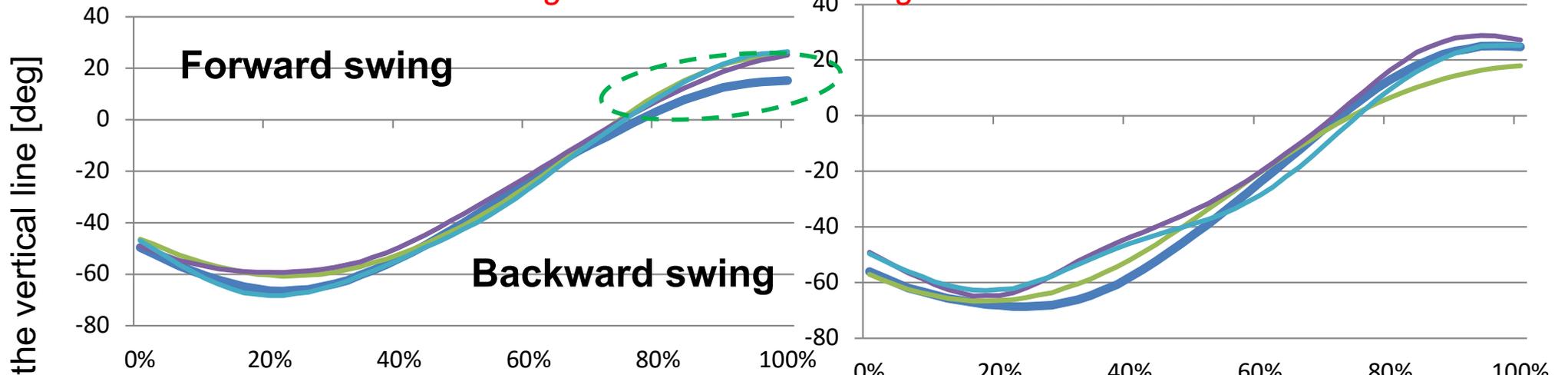
M50kmW Heel height ratio to the body height during swing phase



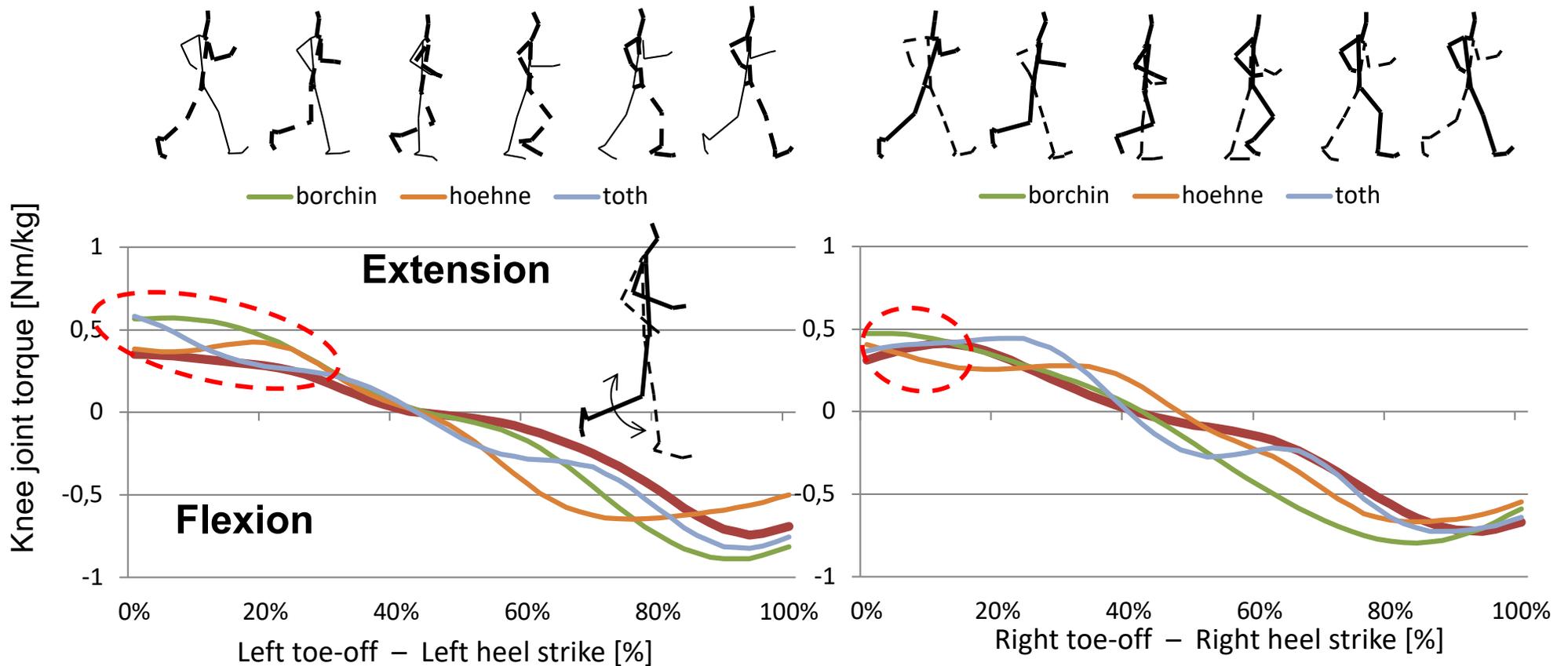
M50kmW Shank angle during swing phase



Shank angle of DA-A was not larger than other walkers



M50kmW Knee joint torque during swing phase of Second group

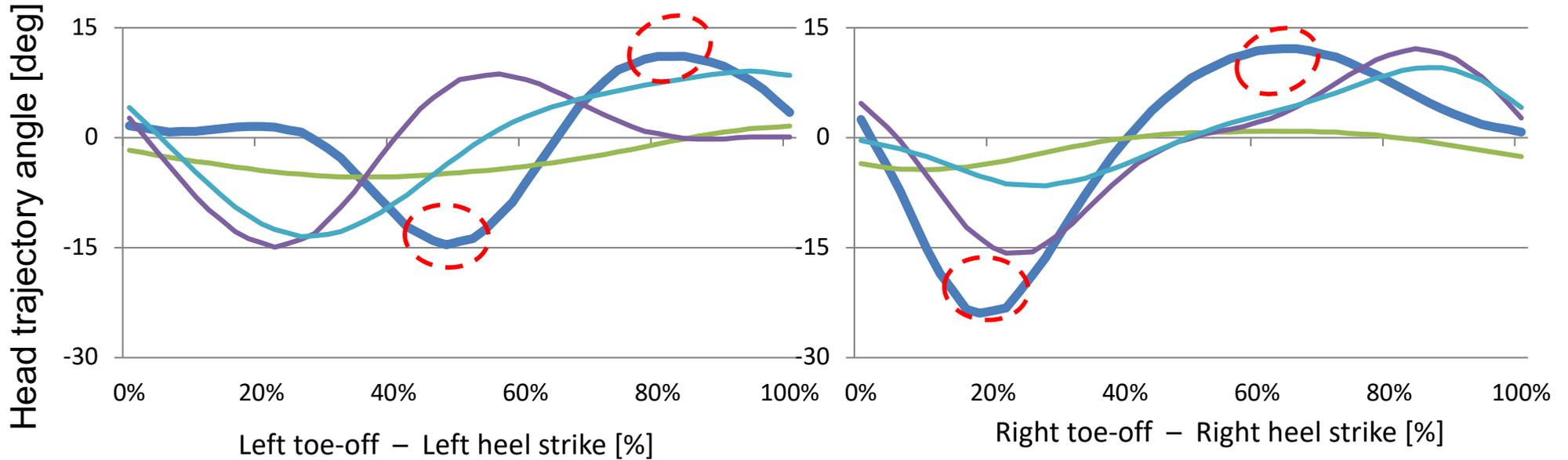
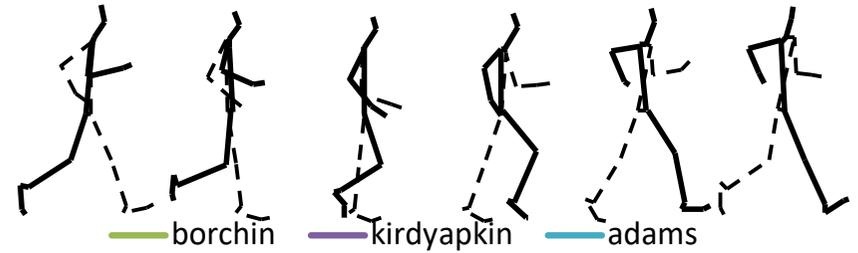
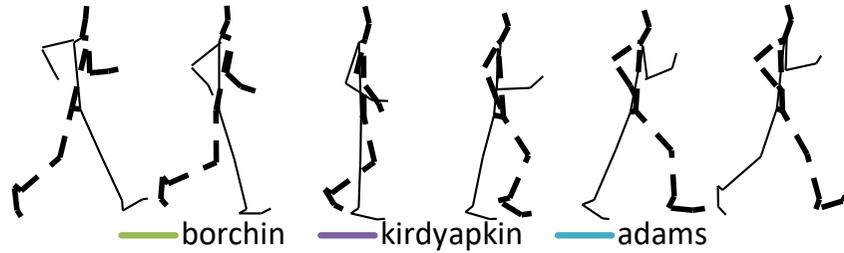


Knee extension torque of DQ-B was smaller than other three walkers

⇒ Kick up just after toe-off was not reduced.

⇒ It is necessary to train hip abductor which relate to hip flexion and knee extension.

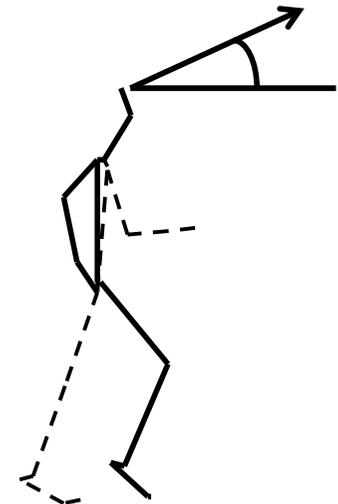
M50kmW First group, Head trajectory angle



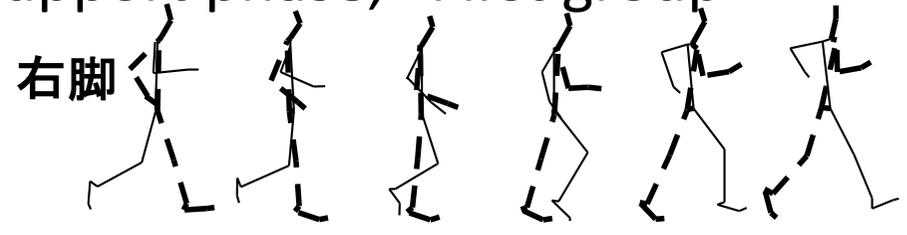
* Head trajectory angle of DQ-A was larger or same as other walkers.

⇒ Kean 'Up and Down'

⇒ Easily visible 'Up and Down'

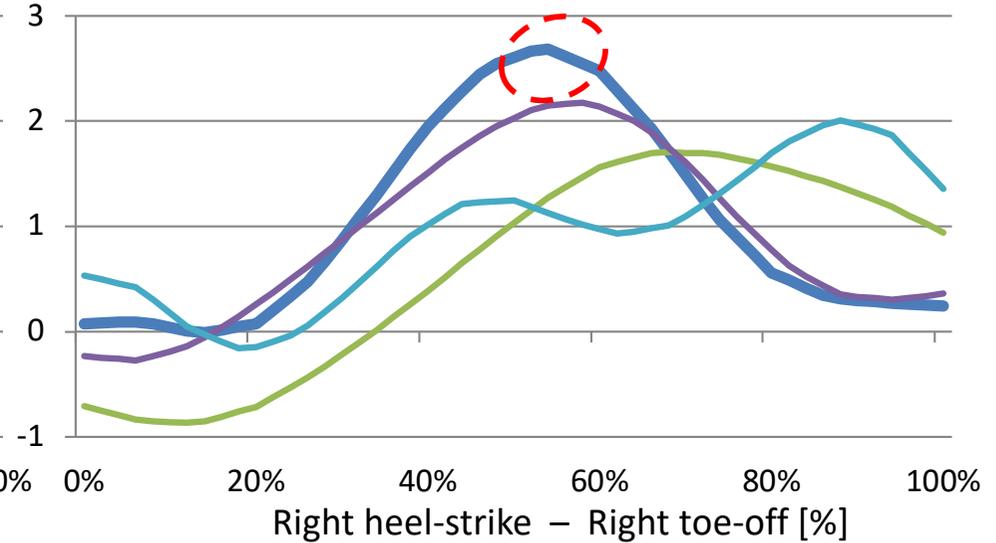
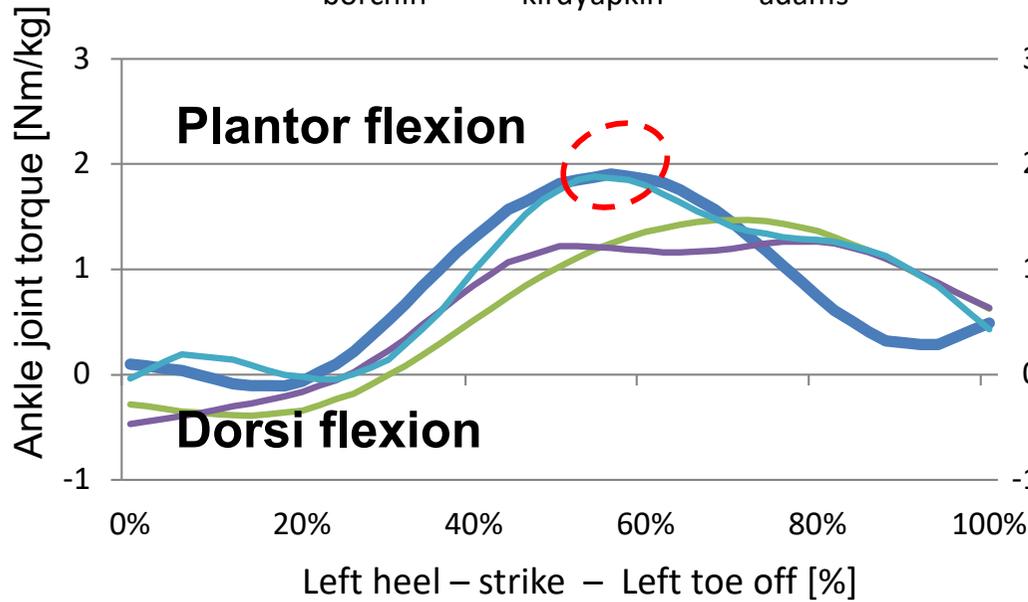


M50kmW Ankle joint torque during support phase, First group



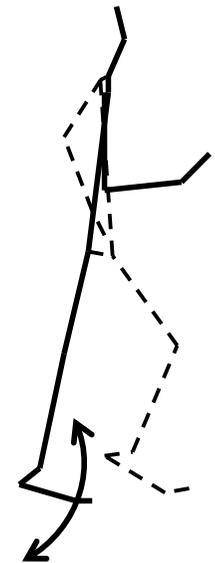
— borchin — kirdyapkin — adams

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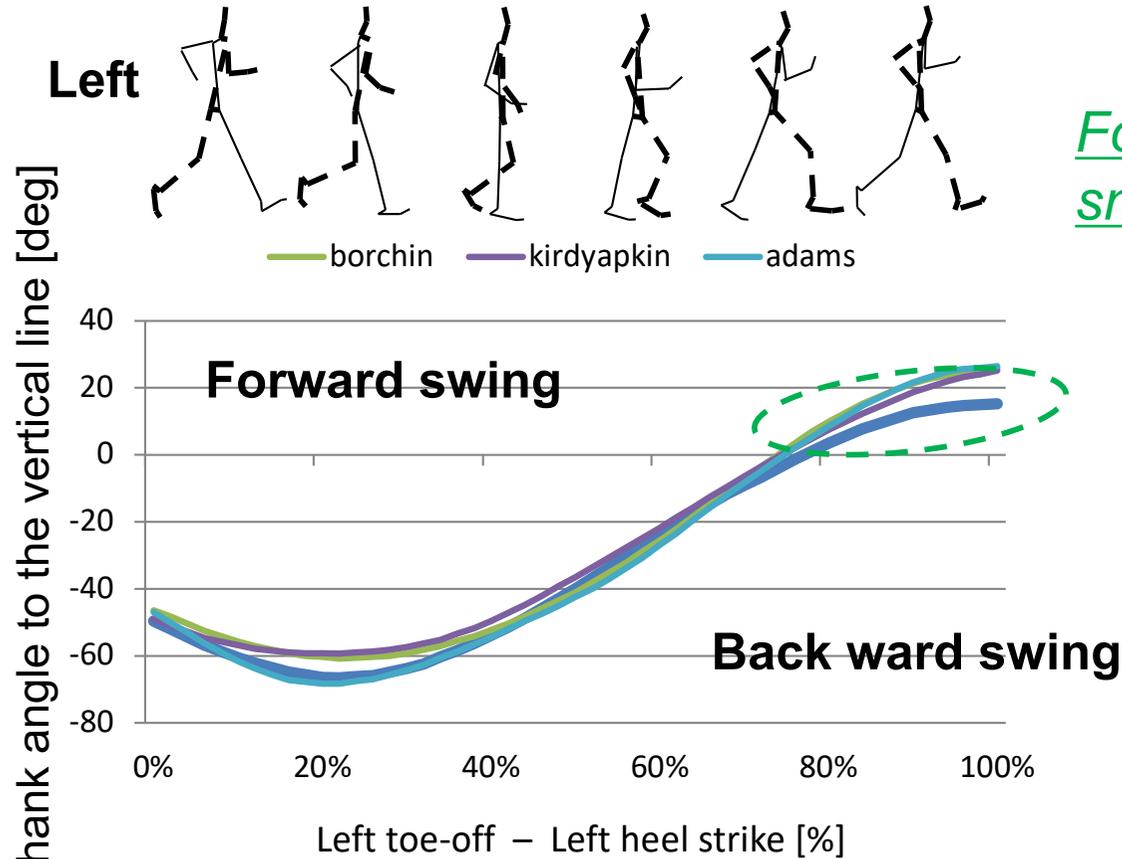


Peak plantor flexors' torque of DQ-A was larger or same as other walkers

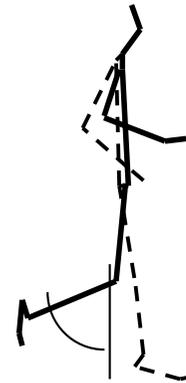
⇒ This torque result in 'Up and Down'.



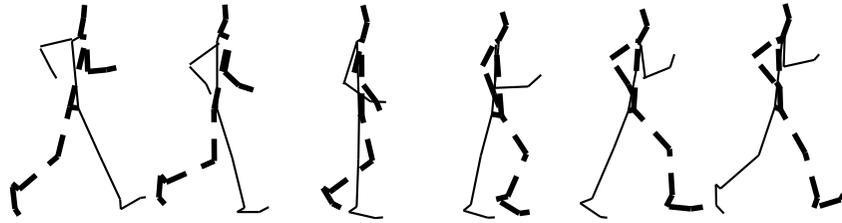
M50kmW Shank angle during swing phase



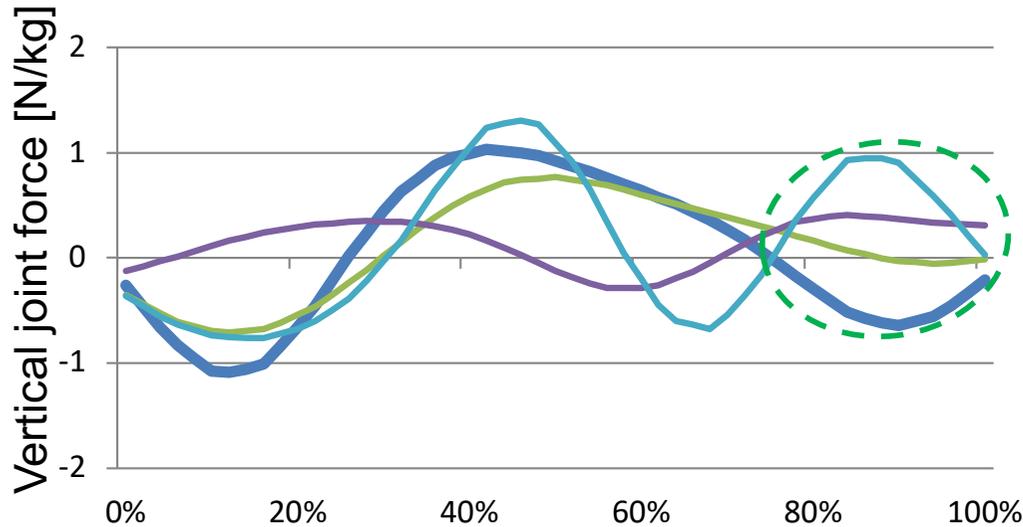
Forward swing of DQ-A was smaller than other walkers



M50kmW Left knee joint vertical force



— borchin — kirdyapkin — adams



*Only for DQ-A, downward force was applied at knee joint.
For other walker, up ward force was applied.*

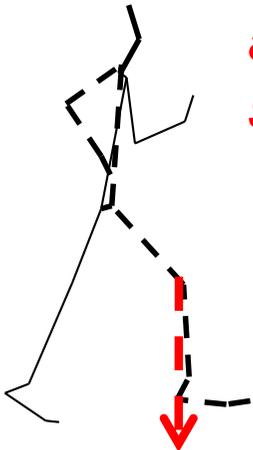
In the phase of downward motion of whole body, downward force was applied at knee joint.

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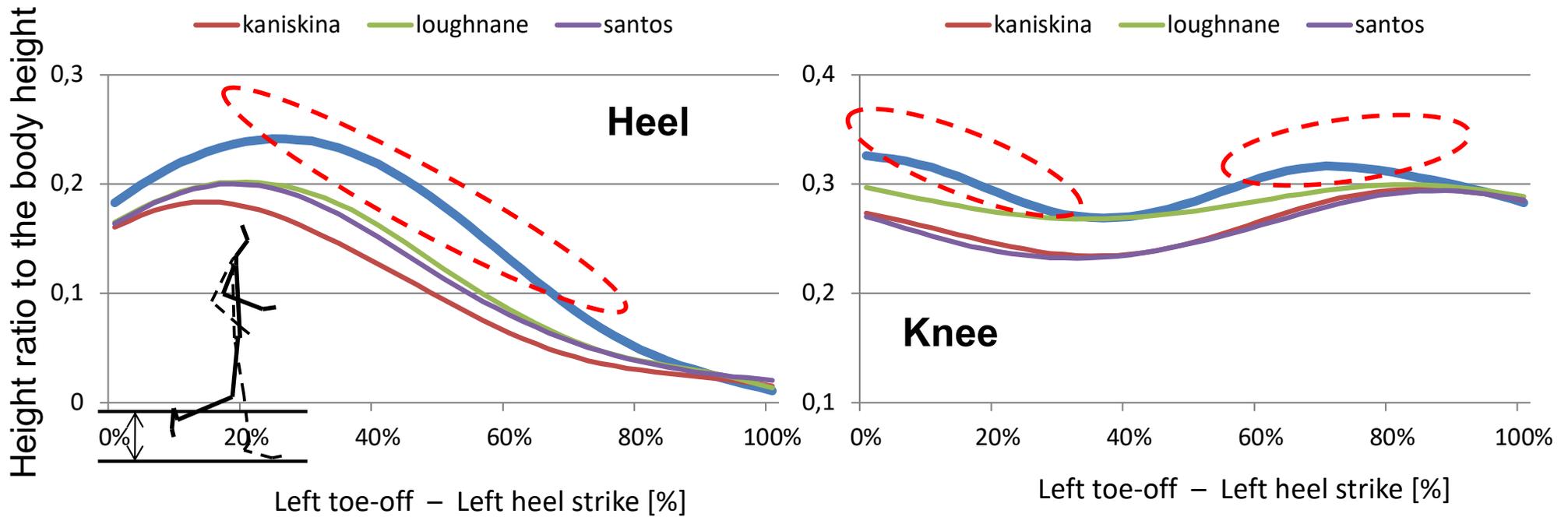
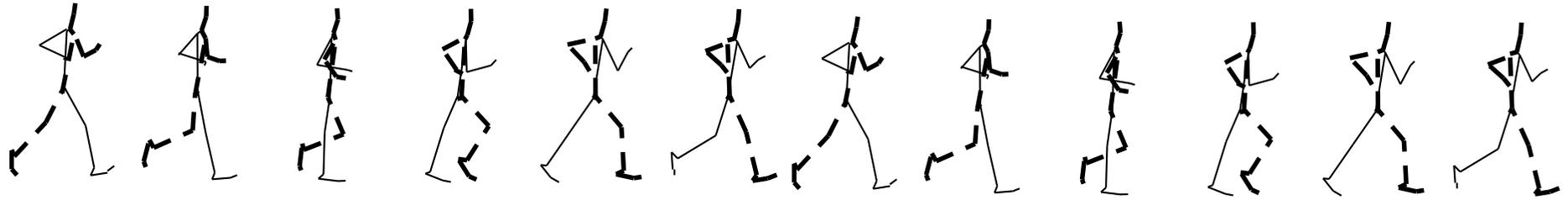
① Down ward force was applied at knee joint when shank was swung forward.

② This force applied in order to reduce forward swing of shank.

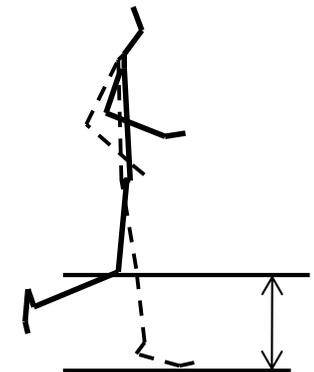
③ Shank was not swung enough forward just before heel contact.



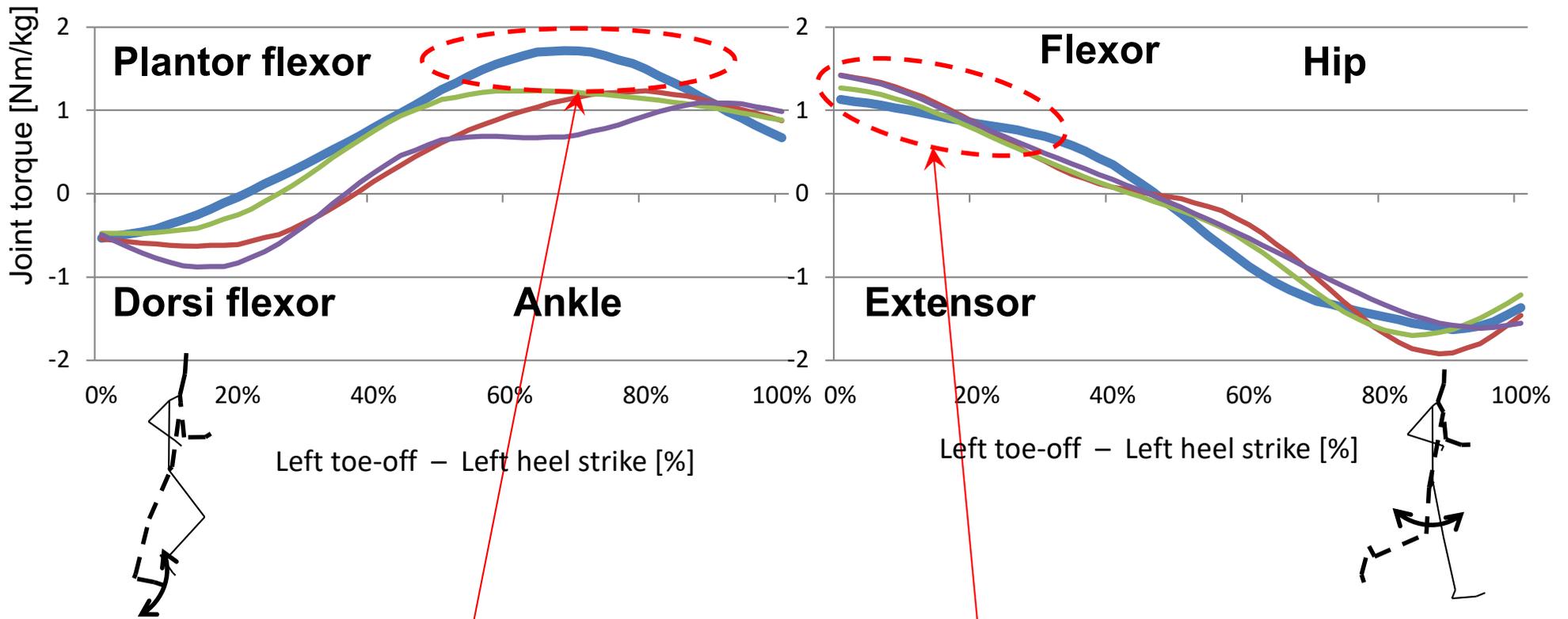
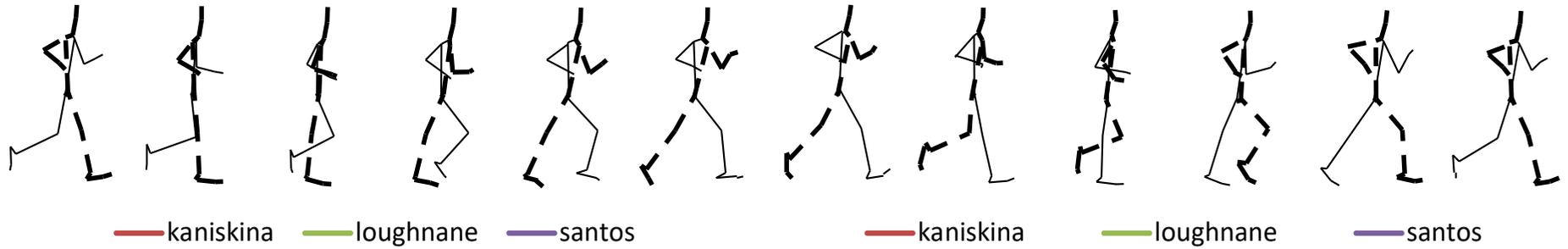
W20kmW Swing heel ratio and knee ratio to the body height.



⚠️ Heel height and Knee height of DQ-C were higher than other walkers.



W20kmW Support ankle torque and swing hip torque



*Ankle torque of DQ-C was larger than other walkers
=> Higher kick up

*Hip torque of DQ-C was smaller than other walkers
=> Weak leg swing

Conclusion

M50kmW (DQ-A)

- Loss of Contact judgment of Head 'Up and Down'
- Large support ankle plantor flexors' torque resulted in large 'Up and Down'.

⇔ There may be difference in strategy of speed acquisition.
With Strong kick of ankle ⇔ With strong leg swing

M50kmW (DQ-B)

- Loss of contact judgment of large kick-up after toe-off.
- It was not possible to reduce kick up because of small knee extensors torque.

⇔ There may be difference in strategy of speed acquisition.
With Strong kick of ankle ⇔ With strong leg swing

Conclusion

W20kmW

- Loss of contact judgment of large kick-up after toe-off.
 - Large support ankle plantor flexors' torque resulted in large Kick-up.
- ⇔ There may be difference in strategy of speed acquisition.
With Strong kick of ankle ⇔ With strong leg swing

How to do ?-1

Strong whole leg swing with hip flexors' and knee extensors' torque



Reduce ankle torque and reduce 'Up and Down' and Kick-up



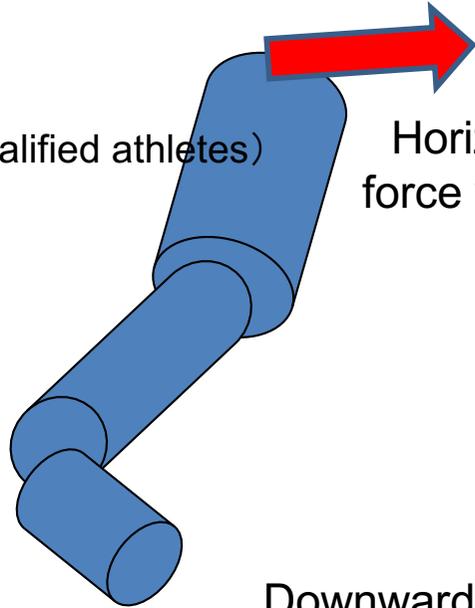
How to do? -2

At Toe-off

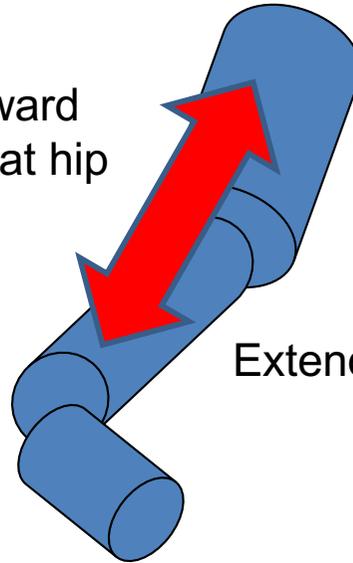
Mid swing phase

A

(Data of qualified athletes)

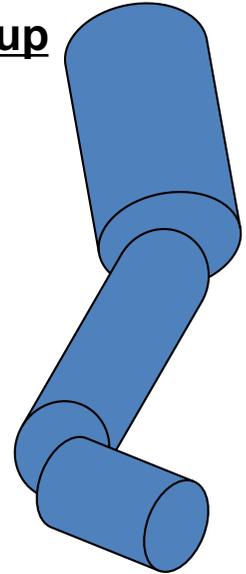


Horizontal or upward force was applied at hip



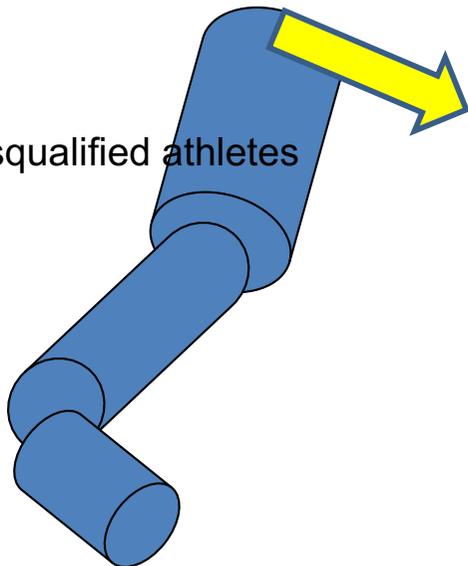
Extend whole leg

Small kick up

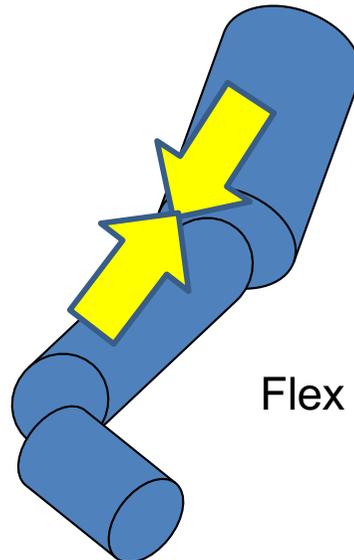


B

(Data of disqualified athletes)



Downward force was applied at hip



Flex whole leg

Large kick up

