WestMARC Gait Analysis – Supplementary Information

The following document explains some the content of the WestMARC gait report (TMP.122) as well as providing key references for the tests used and sources of normal data. Please also refer to document SOP.225 for full details of how the clinical examination is conducted.

'Video Vector' GRF Analysis

Every time we put our feet on the ground, we produce a 'ground reaction force' (GRF). In the gait lab we have technology which can measure people's GRF during walking. Ideally the vertical component of the GRF (Fz) has two distinct peaks, which we call Fz1 and Fz2. Both of these should be greater than 100% of body weight as shown by the graph in Figure 1.

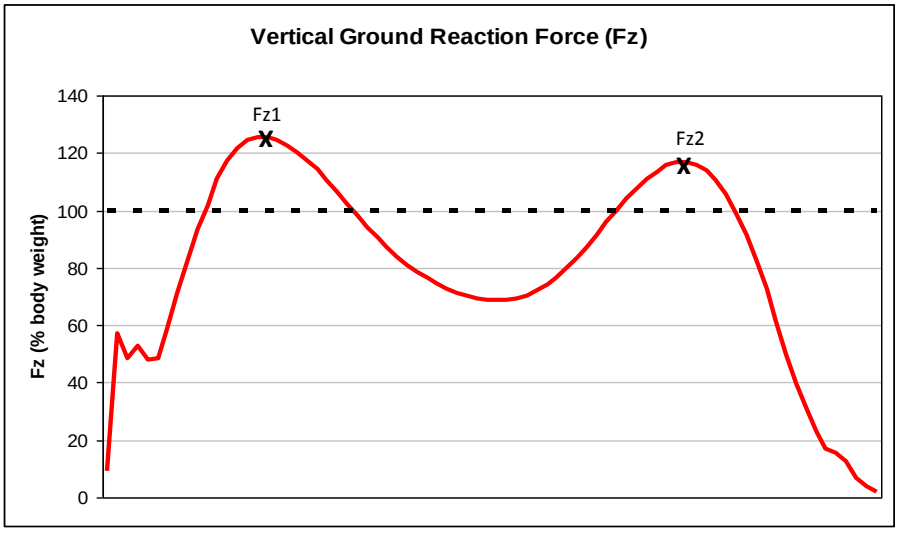

Figure 1: Graph of Fz for a healthy adult during one stance phase, showing both peaks (Fz1 and Fz2) greater than 100% body weight

In the pictures included in our reports the GRF is represented by a thin light blue line. The border between the thicker blue and red sections indicates the point where 100% of the patient's body weight is – so if the top of the thin blue line is in the red section, the Fz at that point is greater than 100% body weight. In Figure 2 you can see the GRF at Fz2 is approximately 115% of body weight. Normal values of Fz2 are 109-121% of body weight.

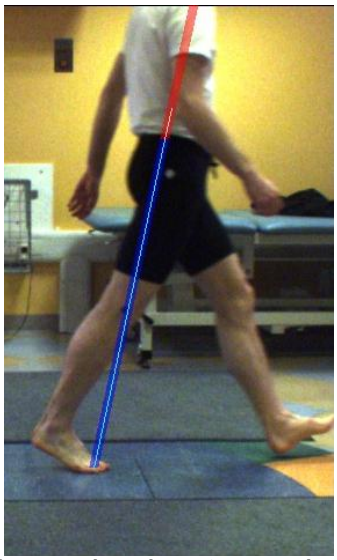

Figure 2: Fz is approximately 115% BW at the point shown

Often patients in the gait have an Fz2 peak which is less than 100% body weight, which is a sign that they have significant difficulties with their walking. Fz2 is particularly important and therefore we often include images of the patient at that specific time point.

In addition to the magnitude of the GRF at Fz2, the alignment of the GRF is also very important. In order to describe the alignment relative to the hip and knee we use the following abbreviations

GRF alignment:	Flex = the GRF causes joint flexion KJC = the GRF passes through the knee joint centre	Ext = the GRF causes joint extension HJC = the GRF passes through the hip joint centre
	ASM = at skin margins WSM = within skin margins	OSM = outside skin margins GOSM = grossly outside skin margins

The ideal GRF alignment at Fz2

At the knee ideally the GRF alignment should pass slightly in front of, or through, the knee joint centre causing slight extension (see Figure 3).

Ext GOSM	Ext OSM	Ext ASM	Ext WSM	KJC	Flex WSM	Flex ASM	Flex OSM	Flex GOSM

At the hip we're looking for the GRF to be passing slightly behind the hip joint centre causing slight extension (see Figure 3).

Ext GOSM	Ext OSM	Ext ASM	Ext WSM	HJC	Flex WSM	Flex ASM	Flex OSM	Flex GOSM

Descriptions above in green are optimal, amber indicates a moderate cause for concern and red indicates a serious cause for concern.

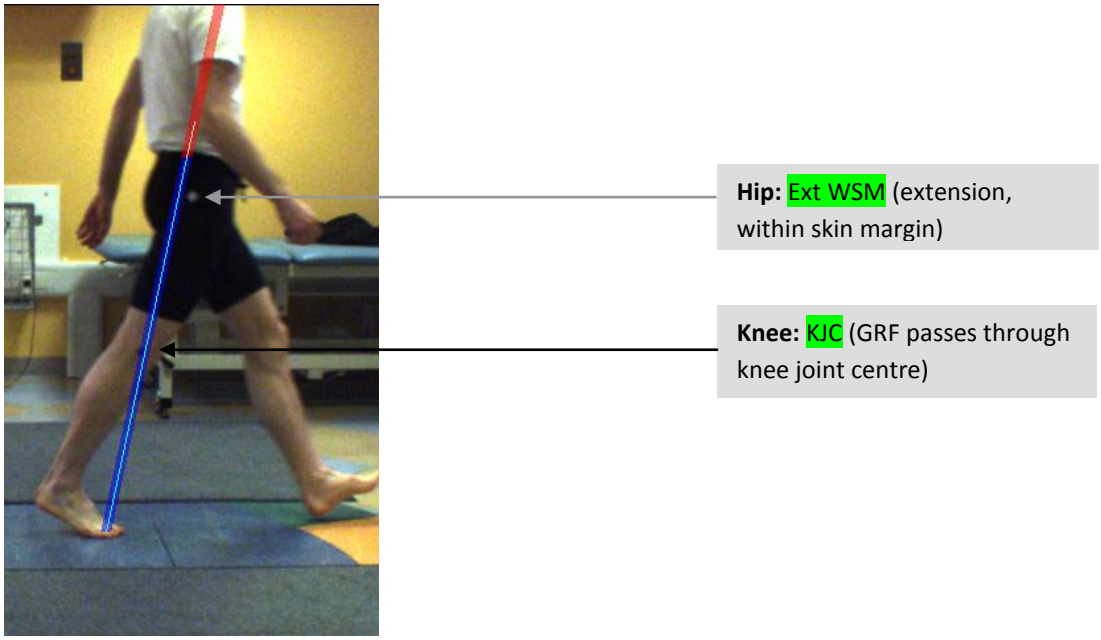

Figure 3 Patient at Fz2, showing ideal GRF alignment producing extension of the hip (Ext WSM) and passing through the knee joint centre (KJC)

In summary, when analysing the data from the gait lab, we are looking for the magnitude of the Fz2 to be greater than 100% BW, and the alignment of the GRF (at Fz2) to be passing in front of (or through) the knee and slightly behind the hip.

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Normal spatiotemporal gait parameters
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Normal 3D kinematic and spatiotemporal gait data source
WestMARC normal gait database. All data locally collected. Controlled storage locations and inclusion/exclusion criteria listed in SOP.293. Basic details in table below:

Age range	n	Age (years)	Male/female ratio
5-7 years	10	6 (0.8)	5/5
8-11 years	10	10.3 (0.9)	5/5
Adults	11	30.8 (4.6)	6/5

Normal clinical examination data source (children)
WestMARC normal clinical examination database. All data locally collected. Controlled storage locations and inclusion/exclusion criteria listed in SOP.293. Basic details in table below:

Age range	n	Age (years)	Male/female ratio
5-7 years	10	6 (0.8)	5/5
8-11 years	10	10.3 (0.9)	5/5

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