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Appendix 1.

Data were collected in a laboratory based environment, where staff had fifteen years of experience in the collection and analyses of gait data related to paediatric orthopaedic patients. Here a 9 camera motion analysis system (Qualisys Medical AB, Sweden) sampling at 120 Hz was used to collect kinematic data as participants performed a minimum of five trials at a self-selected comfortable walking speed. To track movements of the lower limbs, 43 retro-reflective markers were placed at anatomical locations on the trunk, pelvis, and lower limbs, in accordance with the procedure described by Cappozzo et al[1]. During walking trials, 3D ground reaction forces and moments during ground contact were recorded using two AMTI (Advanced Mechanical Technology, Inc., USA) force platforms sampling at 1200 Hz. Kinematic and kinetic data were subsequently analyzed using the Visual 3D (C-Motion, Inc, USA) biomechanics software program. An 8 segment, 3D rigid-link dynamic biomechanical model of the trunk, pelvis, and right and left lower limbs was constructed in Visual 3D. Dempter's anthropometric regression models were used to estimate segmental masses and inertia properties of each segment. Inverse dynamics was used to calculate the net joint reaction forces and moments about the ankle, knee, and hip joints.

The spatial-temporal variables analyzed were gait speed, step width, and stride length. Further data analyses included stance and swing phases from heel strike to next heel strike of the same foot normalised to 101 points. The kinematic variables of interest were discrete sagittal, frontal, and horizontal plane joint angles at the hip, knee and ankle joints (See list in Table IV), some of which being required for the calculation of the Gait Profile score (Baker et al. 2009) For the kinetic analysis the focus was upon maximum power generated across stance phase. Data were averaged across trials. Gait laboratory staff analyzing these data were blinded to the intervention that patients had received.

Plantar pressure data were collected while the patient walked at their self-selected normal speed across an embedded EMED pedography platform (Novel GmbH Inc., Munich, Germany). A minimum of 5 trials for each foot was collected. The evaluation included the following variables: maximum vertical force (% of bodyweight), contact time, (% of time a particular area was in contact with the pressure platform), peak pressure (kPa), pressure time integral which provides a cumulative level of pressure over time in a particular foot area (kPa.s) and Centre of pressure (COP) displacement across the time in stance. Within the Novel software, the PRC mask was utilized to subdivide the foot into 10 anatomical areas (medial and lateral hind, mid and forefoot, as well as toe regions; See Figure 2a). Each trial was visually inspected to ensure appropriate foot anatomy was within the correct sub-areas of the mask. Those with errors were manually modified in the software by an experienced researcher in gait. While this was uncommon, when required it involved

editing features such as toe regions that had been identified within the forefoot (e.g. when toe placement did not occur).

Utilising the pressure-time integral data, a coronal index which has been demonstrated to correlate with clinical varus / valgus foot alignment[2] was calculated. The pressure time integral in kPa.s was summated across the medial midfoot and forefoot regions, and divided by the total to give an impulse of medial foot pressure. The same calculations were undertaken for the lateral side and the difference gives an index of medial versus lateral impulse, and is compared to control group.

References

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