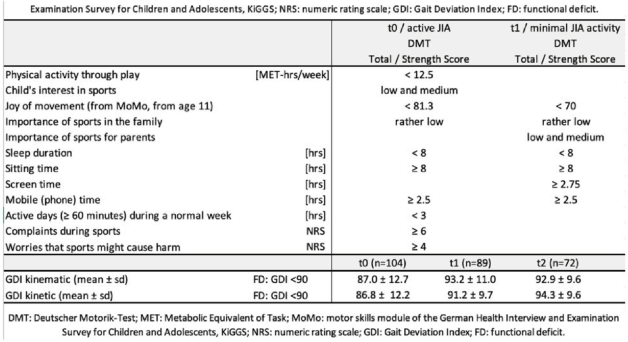
Methods

New incident JIA patients (age 6-16 yrs.) were included at t0 (active JIA) and t1 (minimal JIA activity). 3DMA (12 cameras, Vicon; 4 force plates, AMTI), DMT, medical examination and a questionnaire took place at t0, t1 (start of sport promotion) and t2 (3-9 mth. after t1). At t1, randomization into intervention group (individual sports promotion) and control group (standardized sports promotion) was performed. After imputation of missing data, a predictor analysis was carried out in an exploratory approach (t0-t2) to the total JIA patient group to determine the criteria set. The aim was to detect parameters that indicate functional deficits (FD) in the DMT strength and total score (z < 98) and in walking (Gait Deviation Index < 90 (GDI) kinematics/kinetics, free walking) in patients with active (t0) and inactive disease (t1). Clinical parameters, socio-demographic factors and drug therapy were used as predictors of multiple imputation.

Results

125 (f = 75/m = 50; ø age = 11.0 yrs.) JIA patients were included. There was no objective evidence that certain disease characteristics require 3DMA and DMT after reaching an inactive disease state. The predictor analysis for FD in the DMT (strength and total score) showed subjective parameters (patient related outcomes) at both t0 and t1 (Tab. 1). Regarding 3DMA, no predictors of FD were found for t0 and t1. However, the gait function (GDI kinematic) showed significant improvement between t0-t1 (p < 0.001) but FD persists even in the inactive stage of disease (t1-t2) (Tab. 1).



Examination Survey for Children and Adolescents, KiGGS; NRS: numeric rating scale; GDI: Gait Deviation Index; FD: functional deficit.

		t0 / active JIA DMT Total / Strength Score		t1 / minimal JIA activity DMT Total / Strength Score
Physical activity through play	[MET-hrs/week]	< 12.5		
Child's interest in sports		low and medium		
Joy of movement (from MoMo, from age 11)		< 81.3		< 70
Importance of sports in the family		rather low		rather low
Importance of sports for parents				low and medium
Sleep duration	[hrs]	< 8		< 8
Sitting time	[hrs]	≥ 8		≥ 8
Screen time	[hrs]			≥ 2.75
Mobile (phone) time	[hrs]	≥ 2.5		≥ 2.5
Active days (≥ 60 minutes) during a normal week	[hrs]	< 3		
Complaints during sports	NRS	≥ 6		
Worries that sports might cause harm	NRS	≥ 4		
		t0 (n=104)	t1 (n=89)	t2 (n=72)
GDI kinematic (mean ± sd)	FD: GDI <90	87.0 ± 12.7	93.2 ± 11.0	92.9 ± 9.6
GDI kinetic (mean ± sd)	FD: GDI <90	86.8 ± 12.2	91.2 ± 9.7	94.3 ± 9.6

DMT: Deutscher Motorik-Test; MET: Metabolic Equivalent of Task; MoMo: motor skills module of the German Health Interview and Examination Survey for Children and Adolescents, KiGGS; NRS: numeric rating scale; GDI: Gait Deviation Index; FD: functional deficit.

Conclusions

The assessment of gait function appears to be important and patients' gait should be examined as soon as an inactive disease state is reached. For example, 74% of patients who did not have clinically restricted joints were found to have FD when walking (3DMA). While patients without FD should do sports and require less physiotherapy care (cost saving), inappropriate exercise in patients with FD can lead to exacerbation or secondary problems. The 3DMA is recommended as efficient in terms of resource utilization for JIA patients.

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Femoral derotation osteotomy leads to more medializing patellofemoral force in most individuals with patellofemoral instability

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Background

Increased femoral anteversion (FA) is a known contributor to patellofemoral (PF) instability [1], as it is associated with heightened lateral PF loading [1] [2]. Hence, femoral derotation osteotomy (FDO) are employed for treatment of recurrent PF instability in individuals with excessive FA. Enhancing our understanding of FDO could improve their application to treat PF instability.

We aimed to investigate the effect of FDO on medio-lateral PF joint loading in individuals with PF instability.

Methods

We conducted musculoskeletal simulations using retrospective data from 16 individuals with recurrent PF instability and a FA of at least 30° (mean FA 36.1 ± 4.9°). Two models were created and scaled to each participant. The first model was a generic Opensim model [3], which was personalized to individual FA and tibial torsion using the Torsion Tool [4]. The second model was based on the same personalization, but additionally we simulated FDO by changing the FA to 12°. We calculated joint kinematics, joint kinetics, muscle forces and joint reaction loads using Opensim. We compared PF joint loading pre and post FDO using statistical parametric mapping and correlated change in rectus femoris force to change in peak medio-lateral PF force pre and post FDO. Alpha error was set to 0.05.

Results

Overall, medial PF joint loading significantly increased during stance phase post FDO (Figure 1a). A strong negative correlation was found between rectus femoris force and change in peak medio-lateral PF force (r = -0.79, p < 0.001). Fourteen participants exhibited increasing medializing PF forces post FDO, while 2 showed no change (Figure 1b). Those 2 individuals walked in mean with reduced knee flexion angle and moment during the stance phase (Figure 1c).

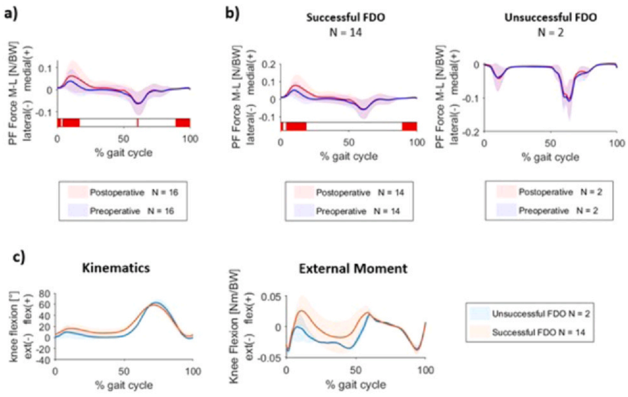

Figure 1: Medio-lateral patellofemoral loading pre- and post-surgery (a), medio-lateral patellofemoral loading in successful and unsuccessful cases (b) and knee kinematics and kinetics (c). Horizontal bars present statistically significant results (p < 0.05). Some plots do not have horizontal bars, due to small sample size of at least one group.

Conclusions

FDO resulted in increased medializing PF forces, likely caused by decreased rectus femoris forces, in all except of two participants. Different knee kinematics and kinetics, which required less quadriceps force, might be the reason for the different results in these two participants. We assumed unchanged gait patterns after the FDO and therefore our results present the sole surgical effects of FDO on PF loads. Changes in gait kinematics post FDO could further alter PF joint loads [5], which was neglected in our study. Our findings support considering FDO as additional treatment in individuals with PF instability and excessive FA, but emphasize the importance of integrating functional assessments such as gait analysis in treatment planning, as effectiveness of FDO may vary between individuals with different gait patterns.

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Fostering the potential of Open Research Data in movement analysis by means of guidelines for data sharing

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Background

The potential in providing and reusing openly available research data is high. However, it raises complex questions such as ownership, confidentiality, and data misuse [1]. This is also the case when providing data of human movement analysis. While there are numerous datasets in the field of human movement analysis [2], many lack comprehensive metadata and thus do not adhere to the FAIR-principles (findable, accessible, interoperable, reusible) which complicates the re-use of data [3]. The aim of this project was to establish guidelines for publishing data collected in human movement laboratories to facilitate FAIR data sharing.

Methods

An iterative approach was employed to develop and refine guidelines based on the FAIR-principles. Initially, a survey on current practices regarding open research data and a workshop to define necessary aspects of the guidelines were conducted. Following this, a draft of the guidelines was created, iteratively adapted and validated, and published.

Results

During guideline development, various aspects that need to be considered throughout the research data lifecycle were detected. However, depending on the project phase, different aspects are of high importance. During project planning, it is crucial to address informed consent requirements, source code descriptions, license types, and data quality check when data from others is reused. During data collection, metadata related to software, hardware, or marker model, should be documented. Source code for data processing and analysis, together with metadata on data cleaning procedures and statistical tests, should be made available where possible. For health-related data, archiving and managing data access after the project ends is mandatory. When sharing data, selecting an appropriate license and repository is essential. Data should at least include the minimum, maximum, mean, and standard deviation of all included outcomes e.g. angle data. Ideally, individual participant data can be shared publicly. However, this relies on the nature of data as encoded data can only be shared when informed consent for reuse is obtained. Overall, anonymization of data is recommended to facilitate data sharing and ensure compliance with the legal and ethical framework. Researchers must ensure the proper quality of reused data through thorough checks.

Conclusions

The iterative approach used for the guideline development in this project has highlighted several critical aspects across the research data lifecycle. Key considerations include early planning for informed consent, comprehensive documentation of metadata, and the availability of open data formats and source code. By adhering to these guidelines, researchers can facilitate more effective data sharing and reuse, ultimately advancing the field of human movement analysis.

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