

Patient Specific Functional Scale Scores: changes during physical therapy intervention

Submitted by

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## **Abstract**

*Introduction:* Hip dysplasia is a developmental malformation of the hip joint where the hip socket does not fully cover the femoral head or where the femoral head has deformities. Physical therapy is often incorporated both before and after a surgical procedure to manage pain and increase function. *Purpose:* This research aims to track the progression of the Patient Specific Functional Scale (PSFS) scores as reported by young adults diagnosed with hip dysplasia undergoing PT. *Methods:* Upon Institutional Review Board (IRB) approval, a comprehensive retrospective chart review was carried out. Data extracted from charts included de-identified demographic information and the PSFS scores for initial evaluation and each reevaluation. Data was sorted by the following groups: pre-operative (PRE) and post-operative (POST), total, and by working definitions of activity categories. Data was analyzed to calculate the average change per progress report (PR) per patient, the total average progress reported from therapeutic intervention, the average improvement per PR per labeled category, and the average improvement over therapeutic intervention per category of activity as reported by the PSFS.

*Results:* The GB group changes were  $+0.773/+2.593$  (PRE/POST),  $+0.702/+1.884$  for ADLs,  $+1.000/+2.867$  for TS,  $-1.330/+2.625$  for SS,  $+0.750/+1.911$  for ST/F, and  $0.000/+3.542$  for Misc. out of 10 points per PR. *Discussion:* Eleven of 12 categorized PSFS score reports displayed clinically significant improvement through therapeutic intervention; however, the value of change was greater for the post-operative group. This data is consistent with the surgical views of Yilar et al. and Gala et al. that PAO surgery is a viable and effective method to manage symptomatic hip dysplasia. *Conclusion:* The PSFS is an accurate and valid functional scale that can report on what the patient deems important to them. The patients reporting saw an excellent improvement with therapeutic intervention, especially post-PAO, as reported by the PSFS.

## **Introduction**

Hip dysplasia is a developmental malformation of the hip joint where the acetabulum does not fully cover the femoral head or where the femoral head has deformities. Hip dysplasia has been reported to be asymptomatic until physical activity level causes issues to present. Symptoms may include partial to complete dislocations of the joint, hip fracture, labral tears, pain, and activity limitations (Gala, Clohisy, & Beaulé, 2016).

A recent study reported that higher activity levels starting at a younger age creates a higher probability that symptoms of hip dysplasia may occur and develop into serious levels of pain (Matheny et al., 2016). Once pain interferes with daily activities, patients begin looking for professional assistance. This assistance may be found through medication, resting from symptom-causing activities, physical therapy, and a surgical procedure known as a periacetabular osteotomy (PAO). A PAO is a surgery in which a surgeon cuts around the acetabulum, which involves four technically challenging osteotomies: supraacetabular, pubic, ischial, and retroacetabular (Zingg et al., 2020). The surgeon would then reorient the acetabular piece to better cradle the femoral head, reattach to the pelvis with very long screws, and fill in the gaps with a filling agent until bone regrows (Periacetabular osteotomy (PAO), 2021). The PAO is a highly successful surgical option to fix hip dysplasia and the pain associated with it (Gala, Clohisy, & Beaulé, 2016). A second, more recent study confirms the success and effectiveness of a PAO to address hip dysplasia (Yilar et al. 2019). Both pre-operative (PRE) and post-operative (POST) physical therapy (PT) is beneficial for strengthening and management of pain, although PT is more effective following surgery as noted by the surgeons conducting the research (Gala, Clohisy, & Beaulé, 2016; Yilar et al., 2019).

As a therapist treats each patient, they assess the change of pain, active range of motion (AROM), strength and functional tasks. Each patient reports his/her perceived changes using outcome measures, for example, the Lower Extremity Functional Scale (LEFS), Modified Oswestry Disability Index, International Hip Outcome Tool (IHOT), and the PSFS. A study by Abbot and Schmitt done in 2014 proved the validity of all aforementioned scales as quality assessments. The standardized outcome measures listed above, are some of the many that provide a common language and score with which to evaluate the success of physical therapy interventions, and to determine which intervention approaches comprise of the best clinical practice (Outcomes measurement, 2020). Outcome measures are utilized by therapists, physicians and insurance companies to best care for a patient needs, track improvement, and justify adequate levels of care and treatment.

Current research, as noted above, has been conducted primarily through the lens of a surgeon. Changes in functional activity across the course of PT intervention for symptomatic hip dysplasia have not been located within the PT literature.

The PSFS is a self-report style of functional outcome measure, depicting minimum detectable change (MDC) (90% CI) for averaging the total values of all tasks of 2 points; and a MDC (90%CI) for single activity scores of 3 points. Figure 1 depicts the patient specific functional scale. The PSFS has intentional blanks to promote patient self-report, as discussed. Figure 2 displays the Lower Extremity Functional Scale, a scale with leading questions of functionality. This demonstration helps visualize the method of data collection, sorting, and analysis. Analysis of the patient-generated components of the PSFS may provide greater understanding of the activity limitations a patient may experience in response to hip dysplasia, and secondarily the pattern of change during PT both before and after a PAO. Activities that

patients report difficulty performing may provide physical therapists with an understanding of the activities that are most frequently impaired by symptomatic hip dysplasia. The research will strive to determine the common functional issues reported in the PSFS and analyze trends commonly experienced by patients with symptomatic hip dysplasia. Furthermore, we seek to investigate the change in function, as evidenced by PSFS scores, in those with and without surgical intervention. We also hope to gain insight into the effectiveness of both physical therapy combined with surgical treatment, and of physical therapy intervention alone. Therefore, the purpose of this research is to track the progression of PSFS single activity scores as reported by young adults diagnosed with hip dysplasia undergoing PT.

### **Methodology**

IRB and administrative approvals were acquired. The retrospective chart review was conducted using electronic medical records from one outpatient physical therapy clinic. Inclusion criteria were: charts discharged between June, 2017 to July, 2019; the individuals being 12-41 years old at the time of the initial examination; the hip being identified as the primary source of symptoms; and results of PSFS scores were reported at least twice throughout the course of care. Charts were excluded if osteoarthritis of the hip was associated with the episode of care, and if the patient was aged over 42 or under 11 at the time of initial evaluation. The chart review was completed, and 45 charts were found to meet the inclusion criteria. These charts were divided into either the PRE or POST groups. 'Pre-operative' indicates that surgery was not planned for the immediate future and 'post-operative' indicates that PT intervention was occurring following a surgical procedure.

Demographics for the patient charts analyzed are listed in Table 1. There were 2 males, and 43 females in the study. A considerable amount more POST group, and reporting an age of 21.1 ( $\pm 8.3$ ) years old at the time of evaluation for therapy.

The data analysis began with the development of working definitions for sorting activities into the following categories: activities of daily living (ADLs), gait and balance (GB), solo sport (SS), team sport (TS), strength training and flexibility (ST/F), and lastly a miscellaneous (Misc.) category. These categories were developed in order to adequately sort and evaluate trends in data as reported by activities on the PSFS. Each activity was then labeled for ease of analysis as patient reports were not always a simple statement or grouped in such a way as to analyze them. All such data breakdown can be seen in Table 2.

Furthermore, the charts were labeled to determine the number of males and females, as well as the number of PRE and POST charts. Mean age and standard deviation were also calculated. Demographic information can be viewed in Table 1. The charts were counted to determine the number of patients that reported just the initial examination (IE), up to 1 progress report (PR), then up to 2 PRs, so on until the maximum number of PRs reported was recorded. One PR usually is required by insurance companies for physical therapy reimbursement and visit approval every 4 weeks.

The total value of improvement per activity was combined, averaged, and divided over the number of PR periods the patient reported for. The value received reflected the average improvement per PR for each patient. These totals were averaged for all 45 charts, and for the PRE and POST groups.

Then, analysis of the total improvement reported by every patient was conducted. This value reflected the overall improvement as indicated by the last IE subtracted from the last PSFS. The score was totaled for all patients, and PRE and POST groups; where each was divided by their respective entries to note a new average. This new average reflected the total average progress reported over therapeutic intervention.

Next, the data was sorted by categorical labels to reevaluate trends and progression averages. The prior two analysis processes were recycled for the analysis of the categorized data: averaged by total, PRE, and POST groups. The result reflected the average improvement per PR per category of activity as reported by the PSFS, and a value of average improvement over PT intervention (i.e. episode of care) per category of activity as reported by the PSFS.

**Results:**

42 charts were reviewed, and the demographic information of the participants are listed in Table 1. Lack of demographics is due to retrospective chart review nature of declassifying data on patients in file. Important identifiers for research purpose was sex of patient, age of patient, and whether patient was PRE or POST.

Table 1: Demographics

	PRE	POST	AGE
<b>Males</b>	0	2	27; 0
<b>Female</b>	15	28	20.8; 8.3
<b>Total:</b>	15	30	21.1; 8.3

RE: Pre-operative; POST: post-operative

The sorted PSFS patient reports are listed as follows in Table 2. Note that responses are summarized into simple phrases to be sorted (i.e. “Flexibility” may summarize patient response “Touch my toes.”).

Table 2: Sorted PSFS Reports

Gait and Balance (GB)	Activities of Daily Living (ADLs)	Team Sports (TS)	Solo Sports (SS)	Strength Training Flexibility (ST/F)	Miscellaneous (Misc.)
Walking	Sitting	Softball	Gymnastics	Exercising	Pivoting
Stairs	Sleeping	Volleyball	Skating	Flexibility	Jumping
Running	Shower	Soccer	Cheer	Moving single leg	Shopping
Walking without crutches	Dressing	Hockey	Tumbling	Squatting	Rolling in bed
			Dance	Weight Training	
			Biking		
			Golf		

Note: Responses listed in table above are simple statements encompassing true patient responses.

Table 3 depicts the average amount of change per PR. The average improvement for a patient per PR was +1.419. The PRE group reported a +0.4237-point improvement per PR and the POST group showed a +1.942 point improvement on the PSFS per PR. Neither sub-group value reached the MDC of 3 points. The average total change over treatment time was +1.77 points improvement over PT intervention. The PRE group reported a change of +0.543 points and the POST group reported +2.313 points over PT intervention.

Table 3: Uncategorized Data [Sort](#)

Pre-op Average Improvement:		Post-op Average Improvement:		Total Average Improvement:	
Per PR:	Per PT Intervention:	Per PR:	Per PT Intervention:	Per PR:	Per PT Intervention:
0.424	0.543	1.943	2.313	1.419	1.770

**Commented [e1]:** 'Per PT Intervention' to me means per visit. I'm thinking you don't mean that. Do you mean per episode of care?, which means the time period from the initial evaluation to the final evaluation?

**Commented [HS2R1]:** Per PT Intervention refers to the whole period of treatment- so yes, per episode of care.

PR: Progress Report; PT: Physical Therapy; Post-op: Post-operative; Pre-op: Pre-operative

Table 4 depicts the average change due to PT intervention as reflected on the PSFS when broken into activity categories. The average change for all patients was +2.01 (GB), +1.41 (ADLs), +2.245 (TS), +1.545 (SS), +1.709 (ST/F), and +3.036 (Misc.) per PR. The value Misc. depicted significant improvement of function by PT intervention regardless of PRE or POST, however further analysis would suggest otherwise. The PRE group changes were +0.773 (GB), +0.702 (ADLs), +1.000 (TS), -1.330 (SS), +0.750 (ST/F), and 0.000 (Misc.) per PR. The POST group changes were +2.593 (GB), +1.884 (ADLs), +2.867 (TS), +2.625 (SS), +1.911 (ST/F), and +3.542 (Misc.) per PR.

Table 4 presents the average change of the categorized data over the total physical therapy intervention period (i.e. episode of care). PRE group values were as follows: +2.530 (ADLs), +3.250\* (GBs), 0.000^ (Misc.), +8.000\*^ (SS), +2.000 (ST/F), and +3.000\* (TS). POST group values were as follows: +3.952\* (ADLs), +4.065\* (GBs), +5.000\* (Misc.), +3.300\* (SS), +3.000\* (ST/F), and +5.000\* (TS). ^ denotes possible error due to small sample size. \* denotes a value of clinically significant change.

**Commented [e3]:** 'period' rather than 'time'

Table 4: Summary of Results

Category:	Pre-op Average Improvement:		Post-op Average Improvement:	
	Per PR:	Per PT Intervention:	Per PR:	Per PT Intervention:
ADLs	0.702	2.530	1.884	3.952*
GB	0.773	3.250*	2.593	4.065*
Misc.	0	0	3.542*	5.000*
SS	-1.333^	8.000*^	2.625	3.300*
ST/F	0.750	2.000	1.912	3.000*
TS	1.000^	2.000	2.868	5.000*

PR: Progress Report; PT: Physical Therapy; Post-op: Post-operative; Pre-op: Pre-operative; ADLs: Activities of daily living; GB: Gait and balance; Misc.: Miscellaneous; SS: Solo sport; ST/F: Strength Training and flexibility; TS: Team sport

**Discussion:**

The purpose of this research is to track the progression of PSFS scores as reported by young adults diagnosed with hip dysplasia undergoing PT. Upon evaluation of the results, it can be stated that every category showed improvement of scores with PT intervention. However, it would be more accurate to conclude that while function improves during PT intervention, the changes in function are more significant if PT occurs post [PAO]. Our findings are consistent with the findings that both pre- and post-operative PT suggests being more beneficial for strengthening and management of pain, although PT is more significant following surgery as

**Commented [e4]:** The way the sentence (and others in the discussion) you are saying that 'function improved because of PT'. Although we want to believe that, this study wasn't about 'cause and effect'. The study is simply examining the change in PSFS scores during a course of PT. I provided a sample sentence that doesn't describe 'cause and effect'. Read it over and see if this makes sense. It is important to modify the wording/ sequence of wording to make this section simply report this idea, and not cause and effect.

noted by the surgeons conducting the research (Gala, Clohisy, & Beaulé, 2016; Yilar et al., 2019). Likewise, we were able to provide insight into the types of skills and functions lost from symptomatic hip dysplasia, and PAO surgery. Such tasks as walking, climbing and descending stairs, ADLs, and pivoting become impaired and are reported as tasks the patient wishes to regain functionality in. The results were unable to report on the specific limiting factors of a task as reported by a patient, such as muscle hurt, joint pain, or range of motion being low.

When discussing the change of activity per PR, it is important to note that nearly all categories of post-op contained a significant value of 2.0 points or greater, only when looking at total group averages. However, MDC per single activity was 3 points, which was found in categorized groups. Furthermore, it is also wise to remember that these values, both clinically significant and otherwise, are per month – not total change. This fact would speak to the impact PT can have on patients questioning receiving a PAO to correct their clinically diagnosed hip dysplasia. This analysis of data would speak to not only the significance of PT, but the effectiveness of the PAO surgery allowing for such an improvement. Thus, the accuracy of change as subjectively seen seems to be objectively reflected well on the PSFS outcome measurement tool.

This data does not reflect an extreme change in solo or team sports due to the scope of the clinic's goals we gather our data from. The clinic where the charts were retrieved is not specifically training sports activities, but they attempt to prepare patients to get back into doing whatever activity they wish to pursue post-treatment. This would be supported with the improvement scores reported by the PSFS in nearly every other category and listed in the last table. Researchers also noticed that the values reported for TS and SS included goals that would drop the averages in the data analysis. For example, a post-op patient recording their ability to

partake in gymnastics just post-surgery would hardly expect to see immediate improvement until their bodies are able to handle that sort of motion and stress – which usually occurs post-PT intervention. Many patients experience some level of muscle atrophy in the surgical leg. So not only would the hip joint need to be stabilized, but the entire leg become strong again. This would include stabilizers, improving range of motion, and being able to absorb force of landing through all joints, muscles, and tendons. Given this process is a timely one, again, the patient report of such functional goals, while admirable, are not feasible to show improvement on during the episode of care. For this reason, the SS and TS categories may not be accurate representations of the true improvement the patient received post-surgery, but only the improvement seen over the episode of care.

To further analyze the last table: this table represents the combining of all scores from the initial examination (IE) to the final PR (i.e. episode of care), sorting by category and finding the averages. This table exemplifies the total impact that was reported by each category as indicated on the PSFS and through our patients. The values indicated in the table do seem to adequately reflect the change seen visibly by both patients reporting, and by the therapists treating.

An important point of thought is that in all areas, regardless of sorting- the POST group carried the averages. This would suggest the level of effectiveness a PAO could have on symptomatic hip dysplasia when coupled with physical therapy intervention. While the goal of this paper is to simply track the progression of functionality scores over the course of care, it is challenging to refute the significance of improvement post-PAO when comparing to pre-PAO treatment.

Further research may wish to include a larger sample size. Sample size greatly affects external validity and is more fitting of the population the greater the sample. Our study was

biased in the fact that researched utilized convenience sampling to procure the charts used in the study. This would also present further research an opportunity for researchers to expand their field of data collection to multiple physical therapy facilities. A question discussed post analysis was about a specific therapist's method of treatment. The trend between a specific form of therapy and functional scale scores would be a beneficial direction to addressing whether change pre-operative or post-operative is affected solely by the surgery, a form of treatment, or not. Expanding the chart collection to multiple therapy clinics and care offices would allow for there to be possible variation in method and approach to treatment of symptomatic hip dysplasia, variation in exercises utilized to strengthen and stabilize, and variation in duration of care.

In addition, we would recommend a more thorough collection of charts. Insufficient chart data storage led to the omission of a handful of potential patients and information. Granted, the retrospective chart review was conducted while the clinic was undergoing a transition to paperless records, some scanning mishaps occurred, which the researchers do not fault the faculty or staff of the clinic for.

Demographic information was lacking in our study. Connections to level of score improvement may be present in subject weight, activity level, ethnicity, socioeconomic status, or employment.

Researcher also discussed the psychological implications of surgery on patients. This pondering led us to question the impact motivation and support found in a physical therapy clinical setting may have on score improvement for post-operative, versus maintenance and continued improvement post episode of care when support and motivation either come from self and close friends.

Lastly, future research may include a vaster pool of self-reports to analyze for trends. Such trends of hindered task functionality could greatly impact suggested methods of treatment by a therapist on symptomatic hip dysplasia. Such things as which muscles are commonly impaired post-PAO, specific tasks that show significant improvement early on to best benefit a patient, and tasks that are unfeasible to work towards without sustaining considerable injury.

**Limitations:**

The sample size of our participants was not as large as we would have hoped for, thus the results cannot be accurately expanded to the total population. The comprehensive retrospective chart review is a method that involves the examination of past records. Researchers using retrospective chart reviews do not have direct control over variables, due to them being more attribute-based variables as collected in clinical charts. Both TS and SS had significant values reported due to there being only one participant reporting in the specified areas above.

Not all participant's charts were able to be used in analysis as some charts were incomplete due to human or computer error in filing for documentation periods of PT treatment.

**Conclusion:**

In conclusion, the data gathered in this study proved to validate the PSFS as a valid measurement tool. The research provided insight into areas such as gait and balance and miscellaneous tasks that are often impaired by symptomatic hip dysplasia. Our results showed that the PAO in combination with physical therapy proved to be an effective strategy to influence functions deemed important by the patients. Furthermore, physical therapy positively impacted

all but one patient who experienced a decrease of function. While not every patient was able to improve to a perfect score by the time of discharge, all patients progressed to better quality of life, as reported by the PSFS.

Figure 1: Patient Specific Functional Scale (PSFS)

Patient: \_\_\_\_\_  
Account #: \_\_\_\_\_

## The Patient-Specific Functional Scale

### Initial Assessment:

Please identify up to three important activities that you can't do or are having trouble doing as a result of the injured area. Write these activities in the first column of the table below under 'activity'. Examples might be: standing to take a shower, walking (without crutches), putting shoes and socks on without help, lying on the painful hip, sleep soundly...

### Follow-up Assessments:

Your therapist will ask you to about the same activities each month. There is a separate column for each month.

### Patient-specific activity scoring scheme

On a scale of '0 to 10', please rate your ability to do each of the activities you listed in the table below. Record the rating in the first 'date' column, if this is the first time you are completing the form.

0    1    2    3    4    5    6    7    8    9    10

Unable to perform activity

Able to perform activity at the same level as before injury or problem

Activity	Date:	Date:	Date:	Date:
	Rate your ability to do each activity 'today'	Rate your ability to do each activity 'today'	Rate your ability to do each activity 'today'	Rate your ability to do each activity 'today'
1.				
2.				
3.				
4.				
5.				

Total score=sum of the activity scores/number of activities  
 Minimum detectable change (90%CI) for average score = 2 points  
 Minimum detectable change (90%CI) for single activity score = 3 points

PSFS developed by: Stratford, P., Gill, C., Westaway, M., & Binkley, J. (1995). Assessing disability and change on individual patients: a report of a patient specific measure. *Physiotherapy Canada*, 47, 258-263

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Figure 2: Lower-Extremity Functional Scale (LEFS)

Patient Name \_\_\_\_\_ Date: \_\_\_\_\_

**THE LOWER EXTREMITY FUNCTIONAL SCALE**

We are interested in knowing whether you are having any difficulty at all with the activities listed below because of your lower limb problem for which you are currently seeking attention. Please provide an answer for each activity. Today, do you or would you have any difficulty at all with:

Activities	Extreme Difficulty Or Unable to Perform Activity	Quite a bit of Difficulty	Moderate Difficulty	A little bit of Difficulty	No Difficulty
1 Any of your usual work, housework, or school activities	0	1	2	3	4
2 Your usual hobbies, recreational or sporting activities	0	1	2	3	4
3 Getting into or out of the bath	0	1	2	3	4
4 Walking between rooms	0	1	2	3	4
5 Putting on your shoes or socks	0	1	2	3	4
6 Squatting	0	1	2	3	4
7 Lifting an object, like a bag of groceries from the floor	0	1	2	3	4
8 Performing light activities around your home	0	1	2	3	4
9 Performing heavy activities around your home	0	1	2	3	4
10 Getting into or out of a car	0	1	2	3	4
11 Walking 2 blocks	0	1	2	3	4
12 Walking a mile	0	1	2	3	4
13 Going up or down 10 stairs (about 1 flight of stairs)	0	1	2	3	4
14 Standing for 1 hour	0	1	2	3	4
15 Sitting for 1 hour	0	1	2	3	4
16 Running on even ground	0	1	2	3	4
17 Running on uneven ground	0	1	2	3	4
18 Making sharp turns while running fast	0	1	2	3	4
19 Hopping	0	1	2	3	4
20 Rolling over in bed	0	1	2	3	4
Column Totals:					

Minimum Level of Detectable Change (90% Confidence): 9 pts      Score \_\_\_\_\_/80

**Note of Gratitude:**

Melodie,

First off, we made it! Who knew it would both feel like it took five years, and yet also only one month to finish this project? I am very grateful for the opportunity to have been selected and accepted into UPTREE and placed onto your research project. I joined on with limited knowledge of the PT world, or of the true technicalities of research. From this experience you have shown me the ropes of the process needed to produce a paper worthy of submission. I learned it takes diligence, patience, and willingness to address mistakes with a constructive mindset. Through this process I not only developed a much higher level of writing, but I was also able to take a small look into the intricacies of the field I will be joining. It is strange to think that so many months have passed by as we have worked on this topic, yet we have only discussed the specifics of just one approach to studying just one topic of just one field. I am beginning to learn that I have much ignorance in the field of physical therapy, of academia, and of research; yet I am excited to say through this experience you have shown me how amazing knowledge for the sake of knowledge can be.

Thank you again for working with me both in the clinic, over zoom, and in person. This year was challenging, and we faced setbacks, but I believe our perseverance to the end of the race speaks to your dedication to your students, your field, and yourself.

Thank you so much for the opportunity to grow as a student and as an individual, this project will not be one so readily forgotten.

Very best and with much gratitude,

Hunter Schulze

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Thank you to all others, I am successful due to the impact you all have made. I am very thankful to be wrapping up my undergraduate studies and beginning OU's DPT school in the fall.

Very Best,

Hunter Schulze

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