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SCHOOL OF OCCUPATIONAL THERAPY

Use of Focus on Therapeutic Outcomes (FOTO®) by Occupational Therapists in Upper Extremity Rehabilitation: Is it Valuable?

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Under the direction of the research advisor:

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A Research Project Entitled

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Abstract

Occupational therapy practitioners treating patients with UE conditions use various patient-reported outcome measures to evaluate patients' function throughout care. FOTO for the UE has limited research to support its use in OT, yet CMS endorses FOTO as a means to measure value-based reimbursement. The purpose of this study was to further explore the utility of FOTO as a functional outcome measure used with patients with orthopedic UE injuries receiving OT services. Using a multiple regression model, researchers found that FOTO intake score, duration of therapy, and injury location were significant predictors of FOTO discharge scores. The number of visits was not a significant predictor. An ANCOVA determined a statistically significant difference in discharge scores among injury locations when controlling for FOTO intake scores. Researchers performed a post hoc analysis with a Bonferroni adjustment showing only one statistically significant mean difference between wrist and hand, indicating that patients with hand injuries tend to have more dysfunction at therapy discharge than wrist injuries. While FOTO does have some advantages as a valid and reliable tool for patients with UE injuries, continued research is indicated to further define the utility of FOTO by OT practitioners.

Use of Focus on Therapeutic Outcomes (FOTO®) by Occupational Therapists in Upper Extremity Rehabilitation: Is it Valuable?

The Centers for Medicare and Medicaid Services (CMS) shifted the health care system from fee-for-service reimbursement to value-based reimbursement so that health outcomes and patient satisfaction ratings can determine reimbursement amounts (Leland et al., 2014). Physical therapy (PT) practitioners commonly use Focus On Therapeutic Outcomes (FOTO) as an outcome measure to assess a patient's functional status throughout rehabilitation following an orthopedic or neurological injury (Colorado Physical Therapy Network, n.d.; Pitchbook, n.d.). Researchers employed by FOTO claimed it is a reliable and valid tool to assess functional impairment following upper extremity (UE) orthopedic conditions and injuries (Chesworth et al., 2014; Hart, 2001). However, researchers noticed gaps in the literature regarding the use of FOTO for patients with UE orthopedic conditions receiving therapy from occupational therapy (OT) practitioners. The purpose of this study is to further explore the utility of FOTO as a functional outcome measure for this patient demographic.

Literature Review

OT for UE Musculoskeletal Injuries

OT is a health care profession that applies a holistic and patient-centered approach when evaluating and treating patients (American Occupational Therapy Association [AOTA], 2020). OT practitioners help people perform their meaningful and purposeful occupations across the lifespan and often treat patients following an orthopedic injury of the UE (AOTA, 2020).

UE orthopedic conditions vary in complexity and recovery time. OT practitioners treat patients for many UE injuries, including carpal tunnel syndrome, cubital tunnel syndrome, trapeziometacarpal arthritis, trigger finger, DeQuervain's tenosynovitis, Dupuytren's contracture,

ganglion cyst, rotator cuff tendinopathy, shoulder osteoarthritis, adhesive capsulitis, and brachial plexus injury (Beleckas et al., 2018; Kennedy et al., 2010; Yannascoli et al., 2018). These types of disorders and injuries often cause "pain, decreased strength, and restricted range of motion that limit participation in meaningful occupational activities" (Marik & Roll, 2017, p. 1).

Typically, an OT practitioner determines specific interventions (i.e., exercises that strengthen and stretch muscles, joint mobilization techniques, use of orthotics, and home adaptations) based on the severity and complexity of the injury location to increase their patient's quality of life (Marik & Roll, 2017; Stonner et al., 2017). OT practitioners must also consider intervention charges based on reimbursement policies and procedures outlined by CMS.

CMS and Value-Based Reimbursement

The goals of value-based reimbursement are to improve health outcomes, enhance patient satisfaction, and reduce the costs of health care (Leland et al., 2014). CMS initiated the Quality Payment Program (QPP) and the Merit-Based Incentive Payment System to reform reimbursement procedures and amounts dispensed to Medicare B providers (QPP, 2019). As of 2019, OT practitioners who treat Medicare B beneficiaries and meet other specific inclusion criteria are required to report data in several categories per the QPP, one of which is quality measures (QPP, 2019). To satisfy reporting requirements for quality, practitioners must measure patients' functional change scores using appropriate outcome tools (QPP, 2019). CMS accepts a variety of tools to measure the quality of services but currently endorses FOTO as its preferred outcome measure because it provides risk-adjusted scores for patients' self-perceived functional status throughout a therapy episode of care (Castleberry, 2015; Colorado Physical Therapy Network, n.d.; Department of Health and Human Services, 2012; FOTO Inc., 2017; QPP, 2019).

FOTO

History and Development

FOTO serves as both a repository of functional status outcome measures and a database that allows for collecting and analyzing scores (Colorado Physical Therapy Network, n.d.). In 1992, three PT practitioners created FOTO as an outcome measure to assess patients who sustained injuries of the lower extremity (LE) (Pitchbook, n.d.). In addition to their existing LE measures, FOTO Inc. more recently created a Shoulder Functional Status measure and the Elbow, Wrist, Hand Functional Status 10-Item Short Form (EWHFS) specifically for patients with conditions or injuries of the UE (FOTO Inc., 2018; M. Werneke, personal communication, October 20, 2020). All FOTO surveys are available in paper format; however, the creators prefer administration to be performed through the more innovative Computer Adaptive Testing (CAT) method (Crane et al., 2006).

Paper Surveys vs. CAT

Researchers deemed the CAT format to improve the precision and efficiency of data collection and utilization (Hart, Wang, et al., 2010). Using the CAT delivery method through the online portal, FOTO delivers questions relevant to a specific injury location concerning the patient's self-perceived difficulty completing tasks (Hart, Deutscher, et al., 2010). The computer algorithm presents varying types and numbers of questions based on the client's answer for the previous question (Hart, Deutscher, et al., 2010). According to Horner (2019), programmers and developers built the CAT versions for individualization, ease, and timeliness, taking approximately one to two minutes. Comparatively, the paper-and-pencil version of FOTO required every question to be answered and took five to ten minutes to complete (Horner, 2019). Wang et al. (2019) cautioned about the possibility of the FOTO CAT prematurely terminating

the assessment or asking irrelevant items, which could increase the testing burden. Likely for proprietary reasons, it is unknown how the FOTO CAT determines when it has sufficient information and ends the assessment (M. Werneke, personal communication, October 20, 2020). Similarly, FOTO CAT has an unknown number of questions in its test bank, and is difficult to achieve a perfect score on the assessment (M. Werneke, personal communication, October 20, 2020).

Comparing FOTO to other UE Questionnaires

FOTO developers derived the questions used on the EWHFS from the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire and the Upper Extremity Functional Index (UEFI-20), two outcome measures commonly used in UE rehabilitation (FOTO Inc., 2018). The DASH questionnaire, which demonstrates good validity and strong reliability, measures symptoms and level of impairment for those with musculoskeletal disorders of the UE (Franchignoni et al., 2014; Gummesson et al., 2003; Kennedy et al., 2011; Kitis et al., 2009; Raven et al., 2008). The questionnaire contains 30 items and detects changes in disability over time (Case-Smith, 2003; Gummesson et al., 2003). The assessment includes questions regarding how difficult functional tasks have been for the patient over the past week and the rating of severity of pain, tingling, weakness, and stiffness (Institute for Work and Health, 2006). The UEFI-20 operates similarly to the DASH as it asks patients to rate their abilities with “tying or lacing shoes” and “opening a jar” (Hamilton & Chesworth, 2013, p. 1513), and it is also valid and reliable in measuring UE function (Chesworth et al., 2014).

The DASH and the UEFI-20 questionnaires provide information regarding a patient’s functional status following an injury to the UE; however, it is unknown if validity, reliability,

and responsiveness remain sound when these tools are modified or shortened or dissected to create the FOTO CAT or EWHFS.

Psychometric Properties

Researchers employed by FOTO claimed the validity and reliability of FOTO and FOTO CAT in assessing impairment following UE injuries (Hart, 2001; Hart, Deutscher, et al., 2010); however, gaps exist in the literature regarding FOTO's value to OT practitioners working in UE rehabilitation (Hart et al., 2001). Moreover, FOTO CAT continuously undergoes modifications to its questions in all the different UE body segment surveys (shoulder, upper arm, elbow, forearm, wrist, and hand) (M. Werneke, personal communication, October 20, 2020). Limited research exists on the psychometric properties of EWHFS and FOTO CAT specifically for UE conditions (Hart & Connolly, 2006). Additionally, there is a lack of research conducted by those not affiliated with FOTO to support these claims (Hart, 2001; Hart et al., 2001).

Purpose

Overall, gaps remain in the literature regarding FOTO's value to OT practitioners working in UE rehabilitation. Therefore, the purpose of this study was to further explore the utility of the FOTO CAT as a functional outcome measure used with patients with orthopedic UE injuries receiving OT services. Specifically, researchers aimed to answer the following questions:

1. Does injury location (shoulder/upper arm, elbow/forearm, wrist/hand), FOTO intake score, the total number of visits, and therapy duration in days predict FOTO discharge scores?
2. Are there differences in FOTO discharge scores among shoulder, upper arm, elbow, forearm, wrist, and hand injury locations when controlling for FOTO intake score?

Methodology

Procedures

After receiving permission from hospital leadership and exempt study approval by the University of Indianapolis Human Research Protections Program, researchers used a quantitative, cross-sectional study design to investigate the utility of FOTO in measuring the functional status of patients with orthopedic UE injuries receiving OT services. Researchers analyzed retrospective data from patients treated between November 2017 through March 2019 at a large hospital-based outpatient therapy department in the Midwest. Data used in the study were previously collected for normal operating procedures at the facility for management, marketing, and reimbursement; therefore, no participants were recruited, screened, or randomized, so informed consent was not necessary to obtain. Researchers hypothesized that the following factors would predict FOTO discharge scores following provision of OT services: injury location, FOTO intake score, the total number of visits, and treatment duration. Researchers anticipated that discharge scores would vary based on injury location when intake scores are held constant for the second hypothesis.

Participants and Data Collection

Participants of the study previously received outpatient OT services for hand, wrist, forearm, elbow, shoulder, or upper arm conditions. Participants were 18 years or older and completed FOTO at therapy evaluation and discharge to meet inclusion criteria. Exclusion criteria consisted of patients not seen by OT hand therapists or those who did not have an orthopedic impairment of their hand, wrist, forearm, elbow, shoulder, or upper arm. To maintain patient and clinician privacy, a qualified hospital employee, not associated with the research

team collected data from the FOTO database and provided de-identified data to researchers for analysis.

Instrument

FOTO CAT was used to measure a patient's functional change from their therapy evaluation to discharge. Before meeting their therapist, patients completed the initial FOTO CAT on a tablet in the waiting area. Therapists verbally administered patients the FOTO discharge survey on the final day of the therapy session using either a tablet or computer, depending on the clinic set-up.

Data Analysis

Researchers received data from 1,259 total participants. Upon preliminary analysis of the data, researchers removed 41.9% (n = 528) of participants who had incomplete FOTO intake or discharge scores. Additionally, researchers excluded 2.9% (n = 37) of participants who had a non-orthopedic injury. Therefore, researchers analyzed a total of 694 participants and conducted the preliminary analysis multiple times to ensure the accuracy of the final data.

Results

Researchers used SPSS Version 23.0.0.0 for data analysis and first calculated the FOTO functional change score for each participant by calculating the difference between the discharge and intake scores. Of the participants, 92.2% (n = 640) experienced an improvement from evaluation to discharge, 1.7% (n = 12) exhibited no change, and 6% (n = 42) demonstrated negative FOTO change scores as their functional status worsened over the course of therapy. Participants were grouped according to injury location, which determined the FOTO CAT version they received (Table 1).

Table 1

Participants

Injury Location	Participants (n)
Shoulder	56
Upper Arm	23
Elbow	94
Forearm	15
Wrist	235
Hand	271

Next, researchers ran a multiple regression to determine if FOTO discharge scores were predicted from patients' FOTO intake score, duration of therapy in days, number of therapy visits, and UE injury location. There was linearity as assessed by partial regression plots and a plot of studentized residuals against the predicted values. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.902. There was homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. There were seven studentized deleted residuals greater than ±3 standard deviations; however, these were kept in the analysis as none resulted from incorrect data. There were no leverage values greater than 0.2 and no values for Cook's distance above 1. The assumption of normality was met, as assessed by a Q-Q Plot. FOTO intake score, duration of therapy, and injury location were significant predictors of FOTO discharge scores, $F(5, 688) = 18.002$, $p < .001$ (Table 2). The number of visits was not a significant predictor of discharge scores. The overall model fit was $R^2 = .109$.

Table 2

Multiple Regression Model

FOTO Discharge Score	*B*	95% CI for B		SE B	β	*p*	R^2	Adjusted R^2
		LL	UL					
(Constant)	51.80	46.75	56.84	2.57		.00	.11	.12
Middle Arm	-1.66	-5.53	2.21	1.97	-0.04	.40		
Lower Arm	-0.63	-3.80	2.54	1.62	-.02	.69		
FOTO Intake Score	0.31	.25	.38	.04	0.37	.00*		
Duration	0.06	.01	.09	.02	0.14	.01*		
Number of Visits	-0.05	-.25	.16	.10	-0.03	.64		

Note. B = Model = "Enter" method in SPSS Statistics; *B* = unstandardized regression coefficient; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; *SE B* = standard error of the coefficient; β = standardized coefficient; R^2 = coefficient of determination; ΔR^2 = adjusted R^2
*$p < .05$. **$p < .001$.

Researchers then performed an ANCOVA to determine if differences were present in FOTO discharge scores among injury locations (shoulder, upper arm, elbow, forearm, wrist, and hand) when controlling for FOTO intake scores. There was a linear relationship between FOTO intake scores and FOTO discharge scores for each injury location, as assessed by visual inspection of a scatter plot. There was homogeneity of regression slopes as the interaction term was not statistically significant $F(5, 682) = 0.967$, $p = 0.437$. Standardized residuals for the overall model were all normally distributed except for the wrist, as assessed by Shapiro-Wilk's test, $p > .05$ (Table 3). There was homoscedasticity and homogeneity of variances, as assessed by visual inspection of a scatter plot and Levene's test of homogeneity of variances, $p = .323$. There were five outliers with standardized residuals greater than ±3 standard deviations; these outliers

were included in the analysis as they did not skew the data distribution. After adjusting for FOTO intake score, there was a statistically significant difference in FOTO discharge scores among injury locations (Table 4), $F(5, 687) = 2.720$, $p = 0.019$, $\eta 2 = 0.019$. Post hoc analysis was performed with a Bonferroni adjustment, showing one statistically significant mean difference between wrist and hand (Table 5).

Table 3

Test of Normality as assessed by Shapiro-Wilk

Body Segments	*p-value*
Shoulder	.084
Upper Arm	.078
Forearm	.306
Wrist	.005
Hand	.196

Note. Standardized Residual for FOTO discharge scores

Table 4

ANCOVA

Injury Location	Participants (*n*)	Unadjusted		Adjusted	
		M	SD	M	SD
Shoulder	56	65.32	12.25	68.57	1.76
Upper Arm	23	68.74	13.09	68.96	2.68
Elbow	94	68.38	14.78	66.97	1.34
Forearm	15	73.07	8.66	72.88	3.32
Wrist	235	65.59	13.98	65.95	0.84
Hand	271	70.18	13.1	69.68	0.78

Note. N = number of participants, *M* = Mean, *SD* = Standard Deviation, *SE* = Standard Error

Table 5

Post Hoc with Bonferroni Adjustment

Body Segment	Body Segment	Estimated	SE	95% CI Mean Difference		*p*-Value
				LL	UL	
Hand	Shoulder	1.11	1.94	-4.60	6.82	1.00
	Upper Arm	0.72	2.79	-7.51	8.94	1.00
	Elbow	2.71	1.54	-1.83	7.25	1.00
	Forearm	-3.20	3.41	-13.24	6.85	1.00
	Wrist	3.73*	1.15	.343	7.12	.019

Note. *The mean difference is significance at the .05 level, adjustments for multiple comparisons: Bonferroni, SE = Standard Error; *LL* = lower limit; *UL* = upper limit; R^2 = coefficient of determination; ΔR^2 = adjusted R^2 *$p < .05$. **$p < .001$

Discussion

FOTO Can Predict Functional Outcomes

Researchers determined through a multiple regression that FOTO discharge scores are influenced by FOTO intake score, injury location, and duration of therapy in days for patients with UE conditions receiving outpatient OT. Results illustrated that the number of therapy visits was not a statistically significant variable in predicting FOTO discharge scores; however, early FOTO researchers studied similar factors and found each to be significant toward the patient's functional outcome (Hart et al., 2001). Our findings coincide with results from more recent studies concluding that the number of therapy visits or length of rehabilitation are not factors influencing function at discharge (Clewley et al., 2020; Cogan et al., 2020). Further research is needed to determine how influential the number of therapy visits or length of rehabilitation is on functional outcomes at discharge.

Functional Differences Following Hand and Wrist Injuries

When controlling for FOTO intake scores, researchers compared the differences in FOTO discharge scores among injury locations (shoulder, upper arm, elbow, forearm, wrist, and hand). The only statistically significant difference in FOTO discharge scores among injury locations existed between patients with hand injuries and those with wrist injuries. Participants with hand injuries experienced worse functional outcomes than those with wrist injuries. Researchers speculate that this difference may result from the hand consisting of more intricate anatomical structures compared to the wrist and the hand being more integral to function. When limited in wrist and forearm motion, many patients compensated with elbow, shoulder, or trunk motions (Carey, 2008; Pereira et al., 2012), whereas it is more difficult to compensate with a hand injury.

Other researchers provided different explanations for significant differences in function among injury location groups. Carlisle et al. (2008) declared football players with elbow injuries often returned to play quicker than players with forearm and wrist injuries. Additionally, De Putter et al. (2014) stated distal UE injuries frequently healed quicker with better health-related quality of life outcomes than proximal UE injuries. Lastly, Jayakumar et al. (2018) broadened the perspective on functional determinants by stating, "psychologic and social factors were more consistently associated with disability than factors related to impairment" (p. 2207-2212). Continued research is necessary to better understand the exact nature and cause of functional differences among injury locations.

Implications for Practice

Although FOTO was the first measure endorsed by CMS (Castleberry, 2015), uncertainty remains regarding the use of FOTO by OT practitioners. For example, much of the research regarding FOTO's utility and psychometric properties was conducted by FOTO Inc. employees and not verified by external researchers. Specifically, Dr. Dennis Hart, the former Director of Research at FOTO Inc., was involved in over 100 peer-reviewed articles supporting FOTO's use and effectiveness (FOTO Team, 2013). If OT practitioners use FOTO to receive reimbursement for services, then clinicians must be certain of its psychometric properties.

As previously mentioned, FOTO appropriated several questions from the more popular and better validated DASH. The QuickDASH, a shorter assessment derived from the DASH, uses similar questions, as well (Kennedy et al., 2011, p. 165). When reviewing these tools, we noticed seven out of the ten questions on the FOTO Paper Short Form used similar verbiage and question format as the DASH. Furthermore, questions asked in the FOTO CAT are not always relevant or clear. For example, one question asks that the participant rate their ability to "manage

transportation needs" (FOTO Patient Outcomes, 2021). This question is vague and may confuse clients, leading to possible concerns of validity.

Along with unclear questions, pain is not assessed on the EWHSF paper form and is not routinely assessed through the FOTO CAT outcome measures (FOTO Inc., 2018). Pain has a significant impact on a patient's functional outcome, and CMS considers it a key measure in determining the value and benefit of care (QPP, 2019). Patients who have pain throughout therapy showed slower progress toward recovery, leading to an increased number of visits and higher health care costs (Cogan et al., 2020). The DASH and QuickDASH both include questions about pain and are free to use (Case-Smith, 2003; Gummeson et al., 2003). It is the authors' opinion that CMS should consider including other, and perhaps more valid, reliable, and useful, outcome measures to satisfy reporting requirements for reimbursement.

Limitations

One limitation of this study involved the potential for inaccurate data entry. At this facility, non-medical personnel entered patient information and selected an injury location in the FOTO database using the referring diagnosis on the order for OT. If the wrong injury location was selected, then the patient was provided the incorrect FOTO CAT assessment. For example, staff unfamiliar with medical terminology may have registered a patient with a radial head fracture under the wrist injury location, when selecting the elbow injury location would have been more accurate. This may have led to skewed results if patients did not complete the proper assessment.

Future Research

Researchers do support the use of FOTO for orthopedic conditions of the LE and utilization in the field of PT (Colorado Physical Therapy Network, n.d.; FOTO, n.d.); however,

we suggest the need for increased evidence supporting the validity and reliability of the FOTO CAT and EWHFS for use with UE conditions. Additional evidence is needed to better establish and support the use of FOTO over other outcome measures in efficiency and practicality in OT practice. We recommend that future researchers address the accessibility and administration of the FOTO questionnaire to evaluate potential barriers to the clients' understanding of the questions. Questions should be specific and clear to enhance accurate reports. Finally, our findings demonstrated significant differences only between wrist and hand functional outcomes, yet multiple studies mentioned previously suggested the impact of other factors on function depending on injury location. Ongoing research efforts should consider these topics to clarify the use of FOTO CAT by OT practitioners treating UE conditions.

Conclusion

Researchers investigated the utility of the FOTO CAT as a functional outcome measure for patients with orthopedic UE injuries receiving OT services. FOTO can be a useful outcome measure; however, researchers outlined concerns about its use instead of other, better-suited measures for UE conditions and OT practice. Until the literature more adequately supports the use of FOTO in OT, CMS should consider endorsing other outcome measures that have well-established psychometric properties determined by external researchers to better influence accurate reimbursement amounts.

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