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Patient Outcomes After Treatment by Athletic Therapy Students

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Context: Patient-reported outcome measures (PROMs) should be used in athletic training and athletic therapy but are rarely incorporated in internships. Student-run clinics are common in other health professions and provide effective treatment and valuable learning environments. To our knowledge, no one has evaluated rehabilitation outcomes in patients treated by athletic therapy students (ATSs).

Objective: To measure the improvement in function in injured patients seeking treatment at an ATS clinic.

Design: Cohort study.

Setting: An ATS clinic.

Patients or Other Participants: A total of 59 patients (32 women, age = 33.9 ± 14.7 years; 27 men, age = 38 ± 14.4 years) from the community with a variety of low back, lower extremity, and upper extremity injuries participated.

Main Outcome Measure(s): At baseline and 6-week follow-up, all patients completed 1 of 3 scales (depending on their injury location) to assess their injured level of function. Scales were the Oswestry Disability Index for low back injuries; Lower Extremity Functional Scale for lower extremity injuries; and Disabilities of the Arm, Shoulder and Hand for upper extremity injuries.

Results: On average, patients received 4.7 ± 1.8 treatments across 48.8 ± 16.1 days. They experienced an increase in function between baseline and follow-up assessments (18.8% ± 20.3%; $P < .001$, Cohen d = 1.06). Moreover, the amount of functional improvement was clinically meaningful, as it was greater than the minimal clinically important difference for each scale. The efficacy of treatments did not differ according to the internship experiences of the ATSs.

Conclusions: Function improved in patients after treatment delivered by an ATS. Patient-reported outcome measures were useful for the students in monitoring patient improvement, but more research is needed regarding effective treatments for patients with chronic pain. Our results suggested that ATS clinics provide effective treatments for patients, service to the community, and a learning opportunity for students.

Key Words: disability, injury, rehabilitation, low back pain

Key Points

- Regardless of the region of injury, patient function improved based on the minimal clinically important difference of each patient-reported outcome measure.
- The efficacy of treatment did not differ between athletic therapy students completing their first versus their second internship.
- Patient-reported outcome measures should always be included in an athletic training or athletic therapy clinical setting to identify what is important to the patient, for routine follow-ups to assess progress, and to assess the end results of services.
- Our results suggest that student clinics provide a cost-effective treatment, service to the community, and a learning opportunity for students.

Patient-reported outcome measures (PROMs) are important in health care and are not used enough in athletic training and athletic therapy, especially in academic programs and internships.[1–3] These measures evaluate patients' perceptions of health status via questionnaires and survey scales.[4,5] Real-time feedback using PROMs such as self-reported functional questionnaires can provide athletic trainers and athletic therapists with a mechanism for assessing the progress of the patient, the injury, and the effectiveness of interventions.[4–6] Such measures should always be included in the clinical assessment to identify what is important to the patient and as a routine follow-up during treatment sessions to assess progress and end results of the service.[4] Clinical outcomes that result from rehabilitation programs and treatment interventions need to be recorded to evaluate the quality of care of any service.[5,6] For athletic therapists working in a field setting, return to play serves as a measure of rehabilitation outcomes; however, according to the National Athletic Trainers' Association, a large percentage of athletic trainers work in a clinic setting.[7] It would also be beneficial to measure PROMs in an internship setting or a student-run clinic to measure students' ability to treat patients.

Every athletic training and athletic therapy program requires students to fulfill academic and practical competencies during internships[8,9]; yet clinical or patient outcomes are rarely measured in this setting.[1–3] Although PROMs are taught in athletic training and athletic therapy programs, supervisors may not use them in the internship setting, which may be why PROMs are not used more frequently.[1–3] These tools provide a glimpse of the patient's perspective of his or her function, which should enhance patient care.[1] Athletic training and athletic therapy programs use a competency-based education model, which traditionally focuses on skill-based learning and not on patient outcomes. The Commission on Accreditation of Athletic Training Education (CAATE) Standards are required for accredited programs, and the standards ensure excellence in athletic training education and improve clinical practice.[8] Athletic training and athletic therapy programs are required to show a progression toward autonomous patient care and prepare students in patient-centered care. Previous researchers[10,11] have suggested that students need to be placed in real-life situations and in settings similar to those of their future profession to transfer the knowledge and skills gained in the classroom into clinical practice.

In athletic training programs, the number of *real-time patients* (ie, actual patients and not actors or other students) for teaching and evaluating the clinical skills of students has increased.[12] Clinics that involve students in assessing and treating the population provide such encounters[12] and may be an effective option for patients. A *student-run clinic* is a term used in other health care professions to describe a health care delivery program in which students are primarily responsible for the logistics and operational management and are capable of delivering targeted interventions to patients.[13,14] Treatments are provided by students, who are supervised by professionals in various disciplines.[13,15] The prevalence of US student-run clinics is high, as they provide a solution for the health care system that is currently facing crises in cost, quality of care, and high rates of people without insurance.[13,14] Data on student-run clinics are more prevalent in health care professions outside of athletic training and athletic therapy, and the effectiveness of student-delivered treatment has been measured in different ways. The most common evaluations of student clinics include measures of the quality of care based on patient satisfaction. Overall, results have been consistently positive and have suggested high satisfaction levels regarding the process of consent, the amount of supervision, and the safety and quality of care itself.[14,16,17] Some investigators[17–20] have measured patients' outcomes to evaluate the effectiveness of treatments delivered by students compared with licensed professionals. Some evidence[14,16–20] indicated that physical therapy and medical students provided effective treatment. For example, Rindflesch et al[19] reported that both physiotherapy students and licensed physiotherapists who treated patients with low back pain effectively planned and delivered care. Whereas a number of authors[13,14] have focused on students in medicine, nursing, physiotherapy, physical therapy, and various other professions, to our knowledge, none have evaluated the outcomes of patients treated by athletic therapy students (ATSs). Therefore, the purpose of our study was to evaluate improvement in the function of patients with a musculoskeletal injury after receiving rehabilitation at an ATS clinic. We hypothesized that all patients would experience increased functional outcomes at follow-up.

METHODS

The ATS Clinic

Our ATS clinic was an internship placement for ATSs who were supervised by certified athletic therapists. Students could complete either of their 2 clinical internships at the clinic. The first clinical internship (6 credits and approximatively 400 hours) was generally for students in their second year of the university athletic therapy program. First-internship students completed courses such as "Assessment of the Upper and Lower Extremities," "Rehabilitation of the Upper and Lower Extremities," "Therapeutic Modalities in Sports Medicine," and "Essentials of Exercise Testing and Training in Athletic Population." The second clinical internship (3 credits and approximatively 200 hours) was generally for students in their fourth year of the university program. Second-internship students completed courses such as "Assessment of the Hip, Spine, and Pelvis" and "Rehabilitation of the Hip, Spine, and Pelvis." Students acquired competencies and fulfilled the academic and practical requirements of a program accredited by the Canadian Athletic Therapists Association (CATA) to enter the CATA certification examination process.[9] Similar to the CAATE 2020 Standards, the CATA competency framework consisted of 7 roles: athletic therapy expert, professional, communicator, collaborator, scholar, leader, and health advocate.[9] As with each internship, the focus is on acquiring certain competencies rather than completing a specific number of hours. The ATSs in the clinic performed all aspects of the patient management model, including taking a history, conducting the physical assessment, determining key impairments, and designing an appropriate treatment plan for each patient's needs. This clinical setting was similar to that described in a study[15] of physiotherapist students using the Mayo Collaborative Model of Clinical Education. Each day began with a case conference at which students met individually with the clinical educator to discuss every patient who would be seen on that day (Figure 1). During the case conference, the role of the supervisor was to oversee each assessment and treatment plan, ensure performance of appropriate tests, and address inquiries. The ATSs were allowed to make decisions with supervised independence. Then, when the patient arrived, the ATS delivered the treatment. The supervisor did not interact with the patient during the assessment or treatment. Second-internship students had acquired more experience because of educational preparation and completion of their first internship, which may have translated into the ability to manage a case load. Initially in their internship experience, ATSs were assigned fewer patients but increased their patient load depending on their progress and schedule. In general, most ATSs started with 1 or 2 patients per day and increased to a maximum of 5 or 6 patients per day. This gradual increase in load was similar to that described earlier in an assessment of physical and occupational therapy students.[15]

The first appointment for a patient with a new injury involved a 55-minute musculoskeletal evaluation; subsequent appointments also lasted 55 minutes and focused on

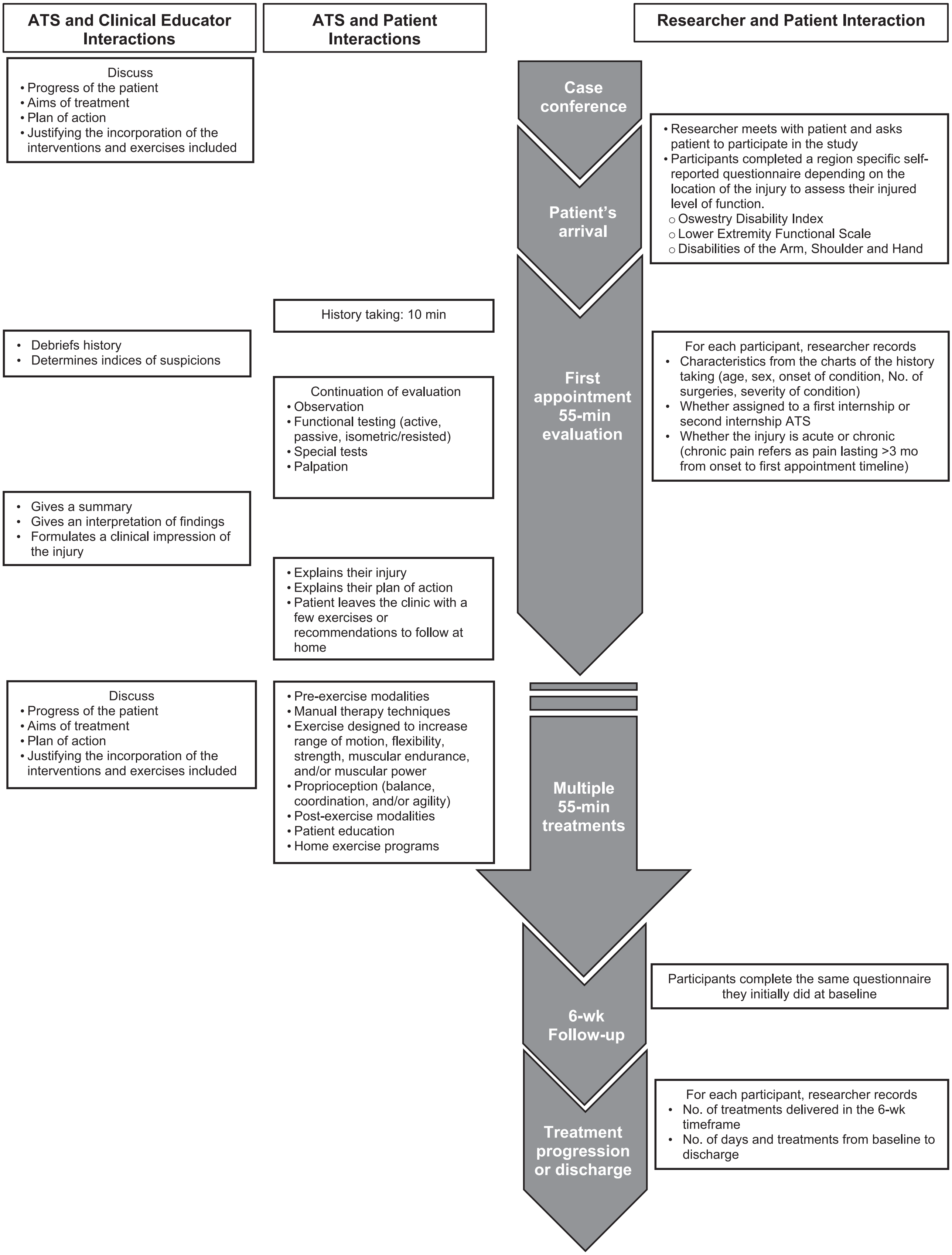

Figure 1. Timeline of rehabilitation, research protocol, and supervisor interactions. Flowchart showing interactions between the athletic therapy student (ATS) and the clinical educator, between the ATS and the patient, and between the researcher and the patient during the complete rehabilitation program of a musculoskeletal injury at the ATS clinic.

rehabilitation. The process of how ATSs interacted with their supervisors and then interacted with the patients is shown in Figure 1. All ATSs prepared a plan for the assessment and rehabilitation before the appointment with the patient. As defined in the "Athletic Therapy Competency Framework" by the CATA, the rehabilitation program depended on the patient's needs and could have included the following: pre-exercise modalities; manual therapy techniques; exercise designed to increase range of motion or flexibility, strength, muscular endurance, muscular power, or proprioception (balance, coordination, agility); postexercise modalities; patient education; or any home exercise program.[8–10] The ATSs were responsible for documenting all interventions. At the end of each evaluation and treatment, supervisors reviewed and corrected the charting documents. At each subsequent appointment, the ATS thoroughly reevaluated the patient, repeated tests and measurements, revised the rehabilitation goals, and modified the rehabilitation program based on the needs of the patient.

Patient-Reported Outcome Measures of Function

We used region-specific PROMs to measure injury and identify how patients progressed during their treatment.[1,4] All patients completed their respective questionnaire either before or after their first appointment and could ask the researcher (F.B.L.) or assistant researcher (R.K.) if they had any questions about the scale. The PROMs were used to assess patients' perceptions of their level of function and were recommended for use in athletic training settings.[1–3,5,6] Depending on the area affected by the injury, patients autonomously completed 1 of 3 questionnaires: the Oswestry Disability Index (ODI) for low back injuries; the Lower Extremity Functional Scale (LEFS) for lower extremity injuries; or the Disabilities of the Arm, Shoulder and Hand (DASH) for upper extremity injuries. All 3 measures were determined to be the PROMs most commonly endorsed by athletic trainers and athletic therapists and were considered appropriate for athletic training use.[1]

Oswestry Disability Index. The ODI[21] is a self-reported questionnaire used to measure disability in patients with low back pain. It demonstrated good validity and excellent reliability (test-retest score range = 0.83–0.99)[22] and was the most commonly cited PROM in the population with chronic low back pain.[1,21–25] The scale consists of 10 domains (Pain Intensity, Personal Care, Lifting, Walking, Sitting, Standing, Sleeping, Sex Life, Social Life, Traveling) with 6 response statements, each describing a greater degree of disability. Each domain is scored on a 0- to 5-point scale, and a total score out of 50 is transformed into a percentage. The maximum possible score is 100, whereas the minimum possible score is 0; a higher score indicates greater disability. The minimal clinically important difference (MCID; 90% confidence) for the ODI was 10% (5 points).[23] A 30% improvement from baseline was considered a generally useful guide of improvement.[23]

Lower Extremity Functional Scale. The LEFS[26] is a self-reported questionnaire used to measure the ability to perform everyday tasks in patients with a lower extremity injury. The scale is composed of 20 items, and each item rates the level of difficulty of functional tasks from 0 (*extreme difficulty or unable to perform activity*) to 4 points (*no difficulty*). The maximum possible score is 80 points, and higher scores indicate better function. The MCID was 9 points,[26] equivalent to 11.25%. The LEFS demonstrated good construct validity (correlation with another scale range = 0.8–0.64)[26] and reliability (test-retest r score range = 0.94–0.98) and was responsive for use in patients with lower extremity musculoskeletal dysfunction that included anterior knee pain[27] and patellofemoral pain syndrome.[28] Moreover, LEFS was the most used PROM for hip and knee dysfunctions.[1]

Disability of the Arm, Shoulder and Hand. The DASH[29] is a self-reported questionnaire used to measure disability in patients with an upper extremity injury. The scale is composed of 30 questions regarding the difficulty in performing different physical activities because of an arm, shoulder, or hand problem. Each question is rated on a 5-point Likert scale, and the final score ranges from 0 to 100, with a higher score indicating greater disability. The DASH had demonstrated high reliability (intraclass correlation coefficient = 0.96).[30] The Pearson correlation between the DASH and the Shoulder Pain Disability Index ranged from 0.82 to 0.88, which indicated very good construct validity.[30] A 10% change was considered the MCID using the DASH,[31] and the scale demonstrated good responsiveness in conditions that included the wrist and hand[30] (eg, traumatic hand injury[32] and carpal tunnel syndrome[33]) and shoulder[30,33] (eg, rotator cuff tendinopathy[34]).

Procedures

Data collection occurred over 11 months, between September 25, 2018, and August 26, 2019, at the ATS clinic. Patients could walk in or be referred from the community. We asked each person reporting for an injury evaluation at the clinic to participate in the study. The researcher (F.B.L.) and assistant researcher (R.K.) met patients before their first appointment to inform them about the study and to answer any questions. All participants provided written informed consent, and the University Research Ethics Committee of Concordia University approved the study protocol (No. 30004539). Before the evaluation appointment with an ATS, we recorded whether the patient was assigned to a student completing the first or second internship. We also recorded descriptive data for each patient and whether the patient had chronic pain (pain lasting >3 months). The patient then completed the scale based on the injured site region: ODI, LEFS, or DASH. In addition, patients completed a health-risk questionnaire, which included questions about current conditions or diseases as well as lifestyle habits, nutrition, alcohol consumption, comorbidities, previous injuries, and family history. Finally, patients signed a form acknowledging they were being treated at a student clinic and teaching facility.

After the initial assessment was completed, patients scheduled their first rehabilitation appointment. All were scheduled to be treated once each week, regardless of injury. All patients attended their regularly scheduled rehabilitation sessions with their respective ATSs. We recorded the number of treatments delivered in the 6-week timeframe and the number of days and treatments from baseline to discharge.

Table 1. Patient Characteristics (n = 59)

Characteristic	No. (%)[a]
Sex	
Female	32 (54.2)
Male	27 (45.8)
Score	
Oswestry Disability Index	12 (20.3)
Lower Extremity Functional Scale	36 (61.0)
Disabilities of the Arm, Shoulder and Hand	11 (18.6)
Pain	
Acute	31 (52.5)
Chronic[b]	28 (47.5)
Athletic therapy student internship experience	
First	44 (74.6)
Second	15 (25.4)
Characteristic	**Mean ± SD**
Age, y	
Females	33.9 ± 14.7
Males	38 ± 14.4
No. of treatments	4.7 ± 1.8
Time between baseline and follow-up, Cohen d	48.8 ± 16.1

[a] Percentages were rounded, so the sum may not equal 100%.
[b] *Chronic pain* was pain lasting >3 mo.

We assessed function again at 6 weeks by having patients complete the same questionnaire they completed at baseline. Binkley et al[26] determined that the LEFS was reliable and responsive over 4 weeks. Researchers also have used the 6-week timeframe when evaluating participant-specific rehabilitation outcomes via the LEFS at baseline, follow-up, and discharge[27]; the DASH for rotator cuff tendinopathy[34]; and the ODI in patients with low back pain.[35] Whereas we agree that not all injured patients will recover fully in 6 weeks, previous authors[27,34,35] have suggested that 6 weeks is enough time to see a difference in these PROMs.

Participants

We approached a total of 358 patients who came to the ATS clinic for an injury evaluation. All patients between the ages of 18 and 65 years who completed the baseline and the follow-up phases were included. Excluded were patients who attended only the evaluation or only 1 treatment appointment because we did not expect them to demonstrate any change in function. We also excluded patients if they had multiple injuries, cancer, nonmusculoskeletal injury, autoimmune disease, cervical or thoracic injury, or concussion or did not speak English or French. Moreover, we did not include a few patients who were being seen long term for more complicated conditions, such as those receiving additional aqua therapy sessions at the clinic. In addition, we did not include patients who were students in the athletic therapy program at the time because their experience with rehabilitation may have affected the results. A few patients came to the clinic for 1 condition for a few appointments, experienced more symptoms in another region, and started receiving treatment for that region; they were excluded because we did not know which injured area to include in the study.

After applying the exclusion criteria, we recruited 191 patients to participate in the study at the baseline phase. A total of 59 (age = 35.8 ± 14.6 years) patients consisting of 32 women (age = 33.9 ± 14.7 years) and 27 men (age = 38 ± 14.4 years) completed the questionnaire at follow-up and were included in the analysis (Table 1). The Consolidated Standards of Reporting Trials (CONSORT) diagram represents progress through the phases of inclusion and exclusion, baseline, follow-up, and analysis (Figure 2).

Data Analysis

We calculated the function score as a percentage at baseline and at follow-up for every patient who completed the follow-up phase. Of the 3 scales, only the LEFS measures function: a higher score indicates more function. The ODI and the DASH measure disability: a higher score indicates more disability. We decided to describe the rehabilitation outcomes of injuries as improvements in function. Therefore, the percentage scores for the ODI and the DASH were inverted, so that a higher score indicated more function. Using the dependent-samples *t* test, we calculated the difference in function percentage over time (from baseline to follow-up) to obtain the improvement in function. We calculated the effect size with Cohen d using the mean of each group at baseline and at follow-up and their respective SDs. Cohen d effect sizes were interpreted as *small* (d = 0.08–0.15), *medium* (d = 0.19–0.36), or *large* (d = 0.41–0.67).[36] Separate analyses of variance were conducted to determine any change in function for each of the following variables: sex, body part (low back, lower extremity, upper extremity), and clinical internship experience of the ATS. We calculated the effect size via η^2 using the sum of squares between groups and sum of squares total. Effect sizes of η^2 were interpreted as *no effect* (0.000–0.010), *small* (0.010–0.060), *intermediate* (0.060–0.140), or *large* (0.140–0.200).[37] Pearson product moment correlations were computed to identify any relationships between the change in function and the following variables: patient age, number of treatments received, and number of days between baseline and follow-up stages. Pearson product moment correlations were interpreted as *negligible* (0.00–0.09), *weak* (0.10–0.39), *moderate* (0.40–0.69), *strong* (0.70–0.89), or *very strong* (0.90–1.00).[38] We used SPSS (version 25; IBM Corp) and set the α level at .05.

RESULTS

Injury Site

Of the 59 patients, 12 patients completed the ODI for low back injuries, 36 patients completed the LEFS for lower extremity injuries, and 11 patients completed the DASH for upper extremity injuries (Table 1, Figure 2). The injuries varied from acute to chronic conditions and by diagnosis and affected anatomic structure, such as ligament sprain, muscle strain, and other musculoskeletal injury.

Number of Treatments

Patients completed the follow-up scale after approximately 6 weeks. All patients were scheduled for treatment once a week, regardless of injury. However, some patients missed appointments or moved them, which affected the frequency. Therefore, patients received an average of 4.7 ± 1.8 treatments across an average of 48.8 ± 16.1 days (6.9 weeks; Table 1).

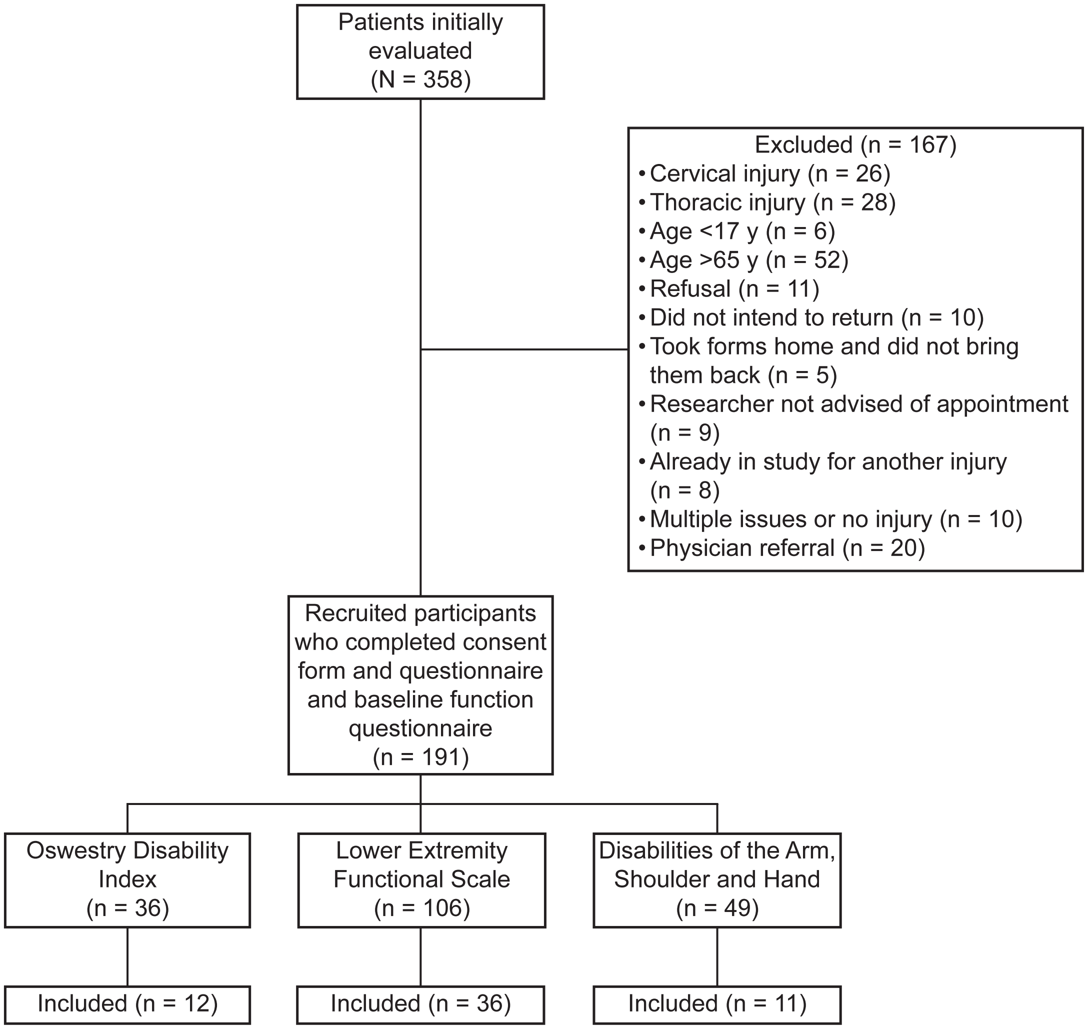

Figure 2. Consolidated Standards of Reporting Trials (CONSORT) diagram illustrating the data-collection process and patient dropout from those seeking treatment at an athletic therapy student clinic for musculoskeletal injuries.

Primary Analysis: Function

Patients seeking treatment at the ATS clinic experienced an increase in function between assessment and follow-up (18.8% ± 20.3%; $P < .001$, Cohen d = 1.06) across all subsets of region and status (acute or chronic). Patient function on average was 66.7% ± 21.6% at baseline and increased to 85.5% ± 12.6% at follow-up (Table 2, Figures 3 and 4).

Injury Site

Among the 3 injury sites, we observed no difference in score at baseline ($P = .06$, $\eta^2 = 0.095$) or at follow-up ($P = .10$, $\eta^2 = 0.078$) or in improvement ($P = .47$, $\eta^2 = 0.027$). Patients with a low back injury (ODI) had an average increase in function of 13.4% ± 13.6% (from 75.6% ± 12.4% to 88.9% ± 10.5%). Those with a lower extremity injury (LEFS) had an average increase in function of 21.3% ± 22.5% (from 61.5% ± 22.9% to 82.8% ± 14.3%). Patients with an upper extremity injury (DASH) had an average increase in function of 16.6% ± 18.7% (from 74.2% ± 20.8% to 90.8% ± 4.9%; Figure 3; Table 2).

Athletic Therapy Students

Across the 11 months, the clinic supervised 22 ATSs (15 students completing their first clinical internship, 7 students completing their second clinical internship). Of the 59 patients, 44 patients were treated by ATSs completing their first internship, and 15 patients were treated by ATSs completing their second internship (Table 1). We noted no difference in functional improvement based on the clinical experience of the ATS. Patients treated by ATSs completing their first internship experienced an increase in function of 18.2% ± 21.5%, and patients treated by ATSs completing their second internship had an increase in function of 20.5% ± 16.6% ($P = .72$, $\eta^2 = 0.002$; Table 2, Figure 5).

Correlation Analysis

We found a negative association between the age of the patient and improvement in function, but the correlation was weak ($r = -0.288$, $P = .03$). In addition, the number of days between baseline and follow-up stages was moderately associated with the number of treatments ($r = 0.688$, $P < .001$). We also identified a relationship between the number of treatments from baseline to follow-up stages and improved function ($r = 0.331$, $P = .01$). Patients who were

Table 2. Changes in Function for Patients Receiving Treatment at an Athletic Therapy Student Clinic

Characteristic	Function, Mean ± SD, % Baseline	Follow-Up	Change	P Value	Cohen d Value	η^2 Value
Total	66.7 ± 21.6	85.5 ± 12.6	18.8 ± 20.3	<.001[a,b]	1.06	
Sex				.50[c]		0.008
Female	63.3 ± 23.5	83.8 ± 14.1	20.5 ± 23.8			
Male	70.8 ± 18.7	87.6 ± 10.6	16.8 ± 15.4			
Score				.47[c]		0.027
Oswestry Disability Index	75.6 ± 12.4	88.9 ± 10.5	13.4 ± 13.6			
Lower Extremity Functional Scale	61.5 ± 22.9	82.8 ± 14.3	21.3 ± 22.5			
Disabilities of the Arm, Shoulder and Hand	74.2 ± 20.8	90.8 ± 4.9	16.6 ± 18.7			
Pain				<.001[b,c]		0.172
Acute	61.6 ± 24.2	88.3 ± 12.0	26.7 ± 20.6			
Chronic[d]	72.5 ± 16.8	82.5 ± 12.9	10.0 ± 16.1			
Athletic therapy student internship experience				.72[c]		0.002
First	66.9 ± 21.1	85.2 ± 11.9	18.2 ± 21.5			
Second	66.2 ± 23.5	86.6 ± 15.0	20.5 ± 16.6			

[a] Determined using a dependent-samples *t* test.
[b] Indicates difference ($P < .001$).
[c] Calculated using analysis of variance.
[d] *Chronic pain* was pain lasting >3 mo.

younger and received more treatments had more improvements in function, but the Pearson *r* value was weak (Table 3).

DISCUSSION

Overall, injured patients from the community seeking treatment at an ATS clinic and treated by an ATS improved their function (18.8% ± 20.3%; $P < .001$, Cohen d = 1.06). Whether patients were treated for injuries of the low back or lower or upper extremity, their function improved posttreatment (low back = 13.4%, lower extremity = 21.3%, and upper extremity = 16.6%).

Minimal Clinically Important Difference

Our main finding was that function improved in all patients, but of note, patients improved their function based on the MCID for each scale. The MCID represents the smallest amount of change in an outcome that might be considered important by the patient or clinician and that indicated the minimum amount of improvement required for a patient to perceive a difference in measured function.[31] The MCID for each scale was achieved: 13.4% ± 13.6% for ODI (MCID = 10%), 21.3% ± 22.5% for LEFS (MCID = 11.25%), and 16.6% ± 18.7% for DASH (MCID = 10%).[31,23,26] Overall, patients with low back pain had the smallest change in function. One reason

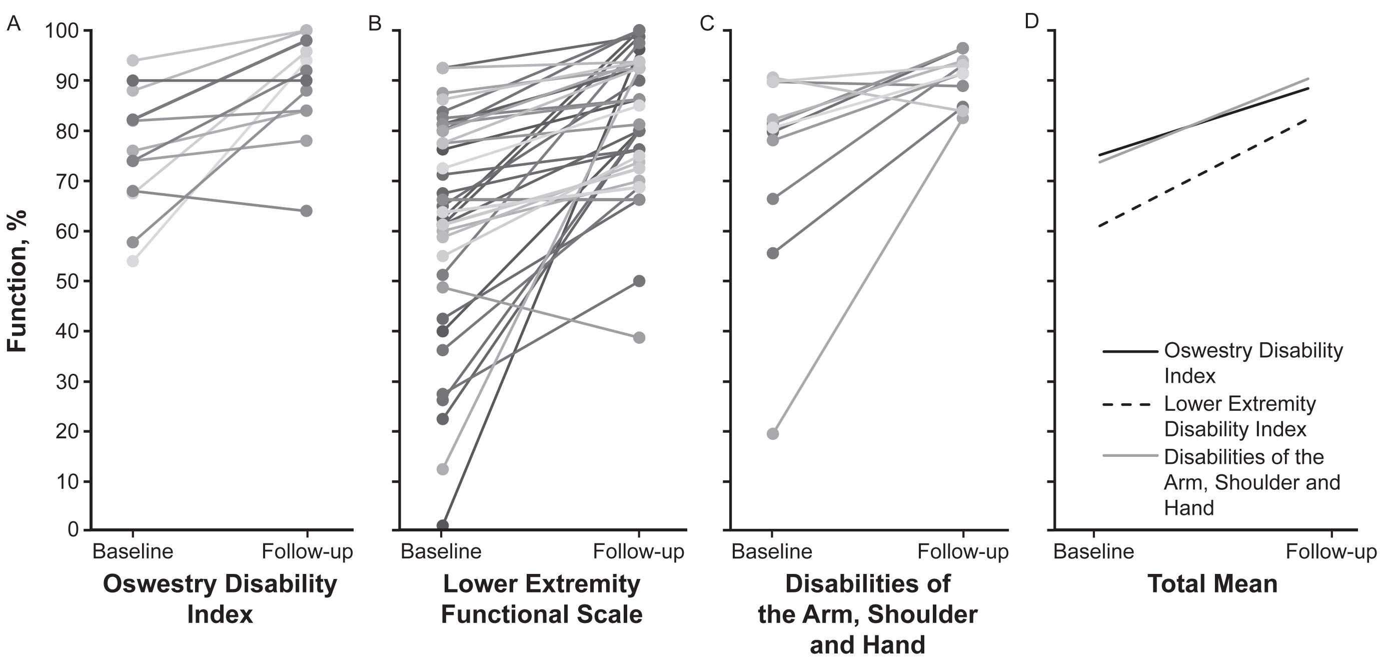

Figure 3. Line graphs illustrating the improvement in function (from baseline to follow-up) in patients with low back pain (Oswestry Disability Index), lower extremity injuries (Lower Extremity Functional Scale), or upper extremity injuries (Disabilities of the Arm, Shoulder and Hand) and the mean improvement in function for each group. Baseline ($P = .06$, $\eta^2 = 0.095$), follow-up ($P = .10$, $\eta^2 = 0.078$), and improvement ($P = .47$, $\eta^2 = 0.027$) scores were not different among the 3 injury groups.

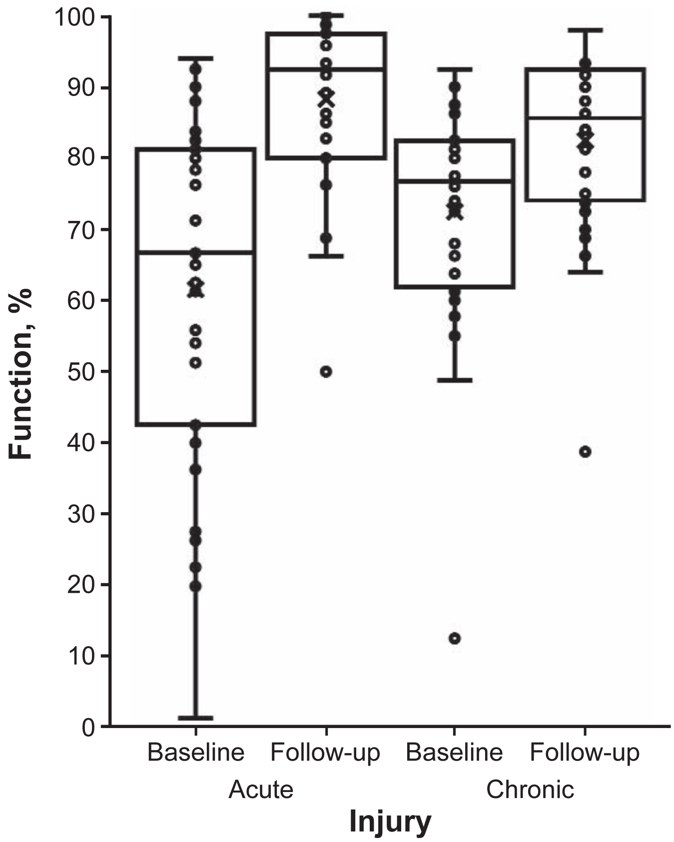

Figure 4. Box plot with points representing levels of function at baseline and follow-up in patients who had an acute injury compared with those who had a chronic injury (pain lasting >3 months). Patients with acute injuries improved more than patients with chronic pain ($P = .001$, $\eta^2 = 0.172$).

for the lower value (or smaller [less] improvement) was the challenge of treating low back pain. The diagnosis and treatment of chronic low back pain have been surrounded by debate, and no clear consensus has emerged on optimal management.[22] Overall, after a rehabilitation program by an ATS, patients with a low back, lower extremity, or upper extremity injury experienced a greater increase in function than the MCID for the respective questionnaire.

Baseline Level of Function

Before the study, we were uncertain about the baseline level of function or how these injured patients would compare with those treated at professional clinics or included in other studies. Based on their level of function at initial assessment, our patients with low back and lower extremity injuries seen at the ATS clinic had similar baseline levels of injury compared with those reported in other studies. Our initial assessment levels of function for the low back and lower extremity injuries were similar to the baseline levels of function in other studies (ODI = 75.6% ± 12.4% versus 70%–80%,[24] LEFS = 61.5% ± 22.9% versus 61%–75% reported by researchers[27,28] examining patellofemoral pain syndrome or anterior knee pain). However, our patients with upper extremity injuries seen at the ATS clinic had a higher level of function than that reported in other studies. Our mean DASH score (74.2% ± 20.8%) was generally higher than in other investigations. For example, the DASH scores given for other conditions included 65% for hand, elbow, and shoulder conditions[33]; 59% ± 20% for carpal tunnel syndrome[33]; and 43.7% for rotator cuff tendinopathy.[34] Moreover, preintervention functional measurements of 55% ± 21% have been described for patients with traumatic hand injuries involving diagnoses such as finger fracture, tendon injury, soft tissue injury, distal radius or carpal fracture, and severe crush.[32]

Clinical Internship Experience

It is interesting that we observed no difference in functional improvement among patients treated by ATSs with different levels of experience. Patients treated by an ATS with less clinical internship experience improved as much as patients treated by an ATS with more experience. However, as will be stated in our limitations, this result needs to be interpreted with caution because the group sizes were different between the ATSs completing their first or second internship. Similar to results for other health professions,[15,18–20,25] we demonstrated that patients treated by ATSs achieved positive outcomes. Rindflesch et al[19] showed that people with low back pain who were treated by student physical therapists experienced similar improvements in function as those treated by licensed physical therapists. Their findings suggested that the plan of care designed and delivered by supervised student physical therapists was as effective as that of licensed physical therapists.[19] Although experience does matter, the similar improvements in function among patients, regardless of the experience level of their ATSs, could be due to the differences in sample size but has also been noted by other investigators.[6] In a previous study,[6] expert physical therapists achieved better outcomes that were associated with spending more time with each patient, reliance on colleagues, use of reflection, and a patient-centered approach to care. We observed that having dedicated 55-minute treatments was a positive patient experience because the ATS was not distracted by other patients at the same time and could develop trust with the patient during the uninterrupted sessions. The ATSs had time, which allowed them to collect a detailed history without being rushed and to check the literature to determine what treatment to implement. We believe that the amount of work spent researching the injury and creating a plan with the supervisor contributed to the improvement in function regardless of the level of internship. We also believe that adequate supervision and attention to the individual competencies of ATSs could positively serve patient outcomes.

Monetary Considerations for a Student Clinic

To balance quality service and minimize costs, the ATS clinic offered health care services to the general public at an affordable rate because the services were delivered by an ATS who was not yet certified. The rate for an appointment at the ATS clinic was CAD $30 (approximately US $24), and the duration of every appointment was approximately 1 hour, constituting less cost and a longer duration than at most other clinics.[39] The patients might have viewed this clinic as a cost-effective option because the cost was less than at a private clinic, considering our results indicated that patients experienced an improvement in function. Regardless of their injury region, patients seeking treatment at the ATS clinic experienced an improvement in function

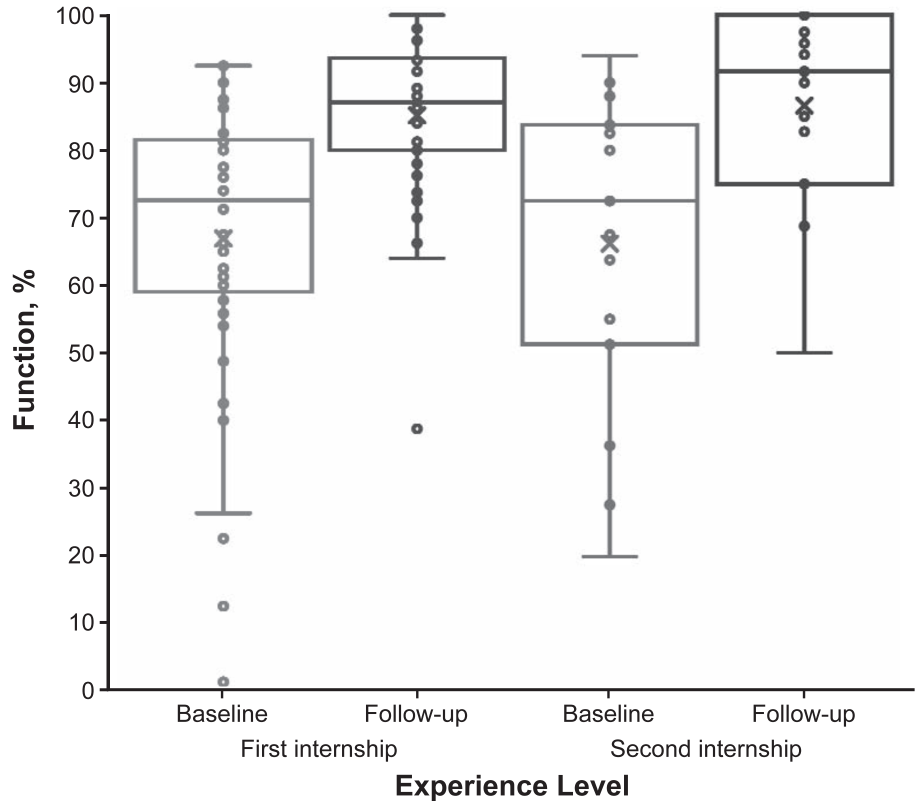

Figure 5. Box plot with points representing levels of function at baseline and follow-up in patients who received rehabilitation treatments from athletic therapy students completing their first versus their second internship ($P = .72$, $\eta^2 = 0.002$).

that reflected the effectiveness of the treatments provided by the ATSs. Future studies are needed to fully determine the cost effectiveness of a student clinic. We cannot draw any conclusions about the cost effectiveness of operating the clinic because we did not include supervisor salary and actual costs at a private clinic for comparison.

Educational Benefit

Every athletic training or athletic therapy program requires students to fulfill academic requirements based on educational competencies, including experience-based learning.[8,9] Students must fulfill competencies and the academic and practical requirements of a program accredited by the CATA to enter the CATA certification examination process.[9] The CATA competency framework integrates the 7 roles of an athletic therapist: expert, professional, communicator, collaborator, scholar, leader, and health advocate. Similarly, the CAATE 2020 Standards provide for the professional preparation of athletic trainers to ensure excellence in athletic training education and improve clinical practice.[8] Athletic training programs are required to show a progression toward autonomous patient care and prepare the student for patient-centered care,[8] which is the goal of our clinic and aligns well with Standards 15 and 16 of the CAATE 2020 guidelines. Standard 15 states, "A program's athletic training clinical experiences and supplemental clinical experiences provide a logical progression of increasingly complex and autonomous patient-care and client-care experiences," and Standard 16 states, "The clinical education component is planned to include at least 1 athletic training immersive clinical experience."[8] However, clinical or patient outcomes are rarely measured in this setting.[1–3] Athletic training and athletic therapy education emphasize skills-based assessment of the student rather than the outcomes of the patients being treated by the student. Future research is needed to examine incorporating PROMs as a way of evaluating students in an athletic training or athletic therapy program. Experiential learning remains a fundamental element of health care

Table 3. Correlations Between Age, Number of Days, and Number of Treatments Between Baseline and Follow-Up Stages and Change in Function

Variable	Age	No. of Days Between Baseline and Follow-Up	No. of Treatments Between Baseline and Follow-Up	Change in Function,[a] %
Age	1	−0.055 (0.681)	−0.084 (.529)	−0.288[b] (.03)
No. of days between baseline and follow-up		1	0.688[b] (<.001)	0.097 (.467)
No. of treatments between baseline and follow-up			1	0.331[c] (.01)
Change in function, %				1

[a] Pearson *r* value (*P* value).
[b] Correlated at the .05 level (2 tailed).
[c] Correlated at the .01 level (2 tailed).

professional education, including medicine.[11,18–20] Students need to be placed in settings that offer situations similar to those of the future profession in order to transfer the knowledge and skills gained in the classroom into clinical practice.[10,11] Yet previous authors[10,12] indicated that the evaluation of clinical skills in students was predominantly via simulations; engagement of real-time patients was less frequent, even if determined to be the most reliable method of evaluation. The skills-based assessment is appropriate for student learning, but at some point, the transition to patient outcomes must occur because the goal of students is to be certified and capable of treating a member of the public. In general, patient outcomes are not used enough in athletic training[1–3] and should be applied and developed more in athletic training and athletic therapy education. In addition to increased use of patient outcomes, the number of real-time patient encounters for teaching and evaluating students' clinical skills, which include student-run clinics, has increased.[12]

Limitations

One limitation of our study was that our consent form and inclusion criteria covered only patients aged $\leq$65 years. During the data collection, 52 patients aged $>$65 years were treated in the ATS clinic for a musculoskeletal injury but not included in our investigation. Before the study, we did not realize how many patients aged $>$65 years would approach the ATS clinic for treatment. Therefore, our results cannot be generalized to patients aged $>$65 years. Future studies are needed to evaluate treatment outcomes in patients aged $>$65 years.

As stated earlier, our results indicating that functional improvement was similar in patients treated by first-internship students and second-internship students must be interpreted with caution. The group sizes were different, with many more students completing their first ($n = 44$) than their second ($n = 15$) internship. Although the functional improvement was similar in these 2 groups, because of the differences in group size, more exploration is needed to determine the effectiveness of student treatments at various stages of their education.

The treatment was not standardized among patients, and this lack of standardization might have affected the overall improvement in function. The principles of the treatment plans were standard (decrease pain, increase strength, increase range of motion, etc); however, the treatment programs were individualized, determined on a case-by-case basis, and different with respect to the injuries and patients. Despite the variability in treatment, the overall effect was an improvement in function.

Following up with patients at 6 weeks was a substantial challenge. Of the 191 patients who completed the baseline functional questionnaire, 59 patients (30.9%) completed their questionnaires at follow-up. This dropout rate was similar to that of other studies, such as O'Sullivan and Hickey,[25] who measured 160 patients at initial assessment, but only 55 (34.4%) of these completed the measure at the final treatment. Increasing the capture rate in clinical research remains a challenge.

CONCLUSIONS

Overall, at the ATS clinic, patients improved their function compared with the respective MCID posttreatment delivered by an ATS. Our results suggested that ATS clinics provide effective treatments for patients, a service to the community, and a learning opportunity for ATSs. Preliminary findings indicated that patients treated by ATSs with less clinical internship experience improved as much as patients treated by ATSs with more experience.

The health care environment is constantly changing, and achieving better outcomes in fewer visits is important for athletic trainers and athletic therapists to demonstrate the value of treatment for the care of common musculoskeletal conditions and to increase patient satisfaction.[6,14,16,18–20] Real-time feedback using PROMs provides athletic trainers and athletic therapists with a mechanism for assessing the progress of the patient, the injury, and the effectiveness of the athletic training or athletic therapy service.[4–6] Patient-based measures should always be included in clinical assessment to identify what is important to the patient and as a routine follow-up during treatment sessions to evaluate progress and facilitate the return to sport or activity.[4]

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