Graston Instrument Soft Tissue Mobilization and Home Stretching for the Management of Plantar Heel Pain: A Case Series

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Abstract

Objective: The purpose of this prospective case series was to describe the outcome of a set of patients with plantar fasciitis treated with Graston Instrument Soft Tissue Mobilization techniques (GT) and a home stretching program.
Methods: Ten patients with a primary report of plantar heel pain completed self-report questionnaires including the Global Rating of Change Scale (GRC), the Numeric Pain Rating Scale, and the Lower Extremity Functional Scale. Patients were treated with GT directed to the triceps surae, soleus, plantar fascia, and medial calcaneal tubercle. Participants received a maximum of 8 treatments over a time frame ranging from 3 to 8 weeks at a frequency of 1 to 2 sessions per week. Each patient was instructed to perform the stretching program at home 3 times daily. Patients completed all outcome measures at baseline, sixth visit (GRC), and at discharge or the eighth visit. The number of successful outcomes on the GRC was examined using a binomial test. Dependent *t* tests were used to examine if a significant difference existed in secondary outcome measures of pain and function.
Results: The subjects had a mean duration of symptoms of 32.4 weeks (SD, 31.1). Patients were treated for an average of 6.9 visits (SD, 1.3). There was a statistically significant difference between the number of patients who did and did not achieve a successful outcome (P = .047). There was also a significant improvement from baseline to follow-up for the Numeric Pain Rating Scale (P = .002) and Lower Extremity Functional Scale (P = .017).
Conclusions: The group of patients selected for this case series who were treated with GT and home stretching experienced clinically meaningful improvement. (J Manipulative Physiol Ther 2011;34:138-142)
Key Indexing Terms: *Plantar Fasciitis; Physical Therapy; Pain*

Heel pain is a common condition in the adult population and often results in significant disability.[1] Plantar fasciitis (PF) is reported to be the most common cause of heel pain and accounts for approximately 1 million physician visits per year.[2,3] Plantar fasciitis affects 10% of the general population.[4-6] Tenderness at the calcaneal tuberosity, which is increased with passive dorsiflexion of the toes, is typically apparent on examination.[1] Symptoms often include sharp stabbing pain that is exacerbated with the first few steps in the morning.[7] The pain of PF normally decreases after brief walking, but it may return after long periods of standing or after getting up from a seated position.[8]

Conservative treatment approaches for PF include corticosteroid injections, low-energy shock wave therapy, night splints, physical therapy modalities, orthotics, soft tissue mobilization, and stretching. However, no management strategies have been shown to be clearly superior in the treatment of this condition.[9] It has been demonstrated that 90% of patients will experience a full recovery with conservative management but this may require 6 to 12 months of treatment and positive encouragement by a physician.[9]

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Graston Technique (GT) is a patented instrument-assisted soft tissue mobilization diagnostic and therapeutic technique developed over a decade ago.[10] Graston Technique uses specially designed stainless steel instruments with beveled edges to augment a clinician's ability to perform soft tissue mobilization.[11] The instruments are used in a multidirectional stroking fashion applied to the skin at a 30° to 60° angle to the treatment site.[11] This application allows the clinician to detect irregularities in the soft tissue texture through the undulation of the gliding tools.[11] In addition to removing scar tissue adhesions, GT has been purported to enhance the proliferation of extracellular matrix fibroblasts, improve ion transport, and decrease cell matrix adhesions as has been hypothesized with transverse frictional massage and extracorporeal shock wave therapy.[6] Studies have shown that the controlled microtrauma induced through GT increased fibroblasts recruitment and activation in an animal model.[12,13] Additional studies have shown clinical efficacy using GT for the treatment of carpal tunnel syndrome,[14] lumbar compartment syndrome,[10] and trigger thumb,[11] but none have investigated the effects of GT on a population of patients with PF. Hence, the purpose of this study was to report the outcomes of patients presenting with PF managed with GT.

Methods

Participants

Patients for this case series were recruited over a 5-month period (June 2009 to November 2009) from 1 of 2 clinics (Advanced Injury Treatment Center, Bedford and Manchester, NH). Patient eligibility included a chief report of plantar heel pain, with tenderness at the calcaneal tuberosity, which is increased with passive dorsiflexion,[1] and a Lower Extremity Functional Scale (LEFS) score[15] of 65 or less. Exclusion criteria included refusal to participate, red flags noted in the patient's medical screening questionnaire, examples included but not limited to fracture, metabolic diseases, and osteoporosis. Additional exclusion criteria included contraindications to manual therapy or modalities, prior surgery to the ankle or foot, insufficient English language skills to complete questionnaires, or inability to comply with treatment and follow-up schedule. This study was approved by the Franklin Pierce University College institutional review board. All patients reviewed and signed a consent form.

Procedures

All subjects provided demographic information and health history and completed a number of self-report measures. This was followed by a physical examination that included palpation to determine the specific location of the patient's symptoms and to determine if tenderness at the calcaneal tuberosity was increased with passive dorsiflexion of the toes.[1] No other standardized examination procedures were performed because it was determined that patients who enrolled in this cohort study would receive the exact same interventions regardless of clinical presentation beyond the inclusion and exclusion criteria.

The primary outcome measure used in this study was the number of reported successes on the Global Rating of Change (GRC).[16] Secondary exploratory analysis included the patient's level of pain as measured with the Numeric Pain Rating Scale (NPRS).[17] The patient's perceived level of disability as a result of their plantar heel pain was measured by the LEFS.[15]

The GRC is a scale that ranges from −7 (a very great deal worse) to zero (approximately the same) to +7 (a very great deal better). Intermittent descriptors of worsening or improving are assigned values from −1 to −7 and +1 to +7, respectively. The test-retest reliability for GRC scales has been reported to be intraclass correlation coefficient = .90.[18] Meaningful improvement on the GRC has been reported to be 5 or greater.[19] Further details regarding the psychometric properties of the GRC can be found elsewhere.[20] We selected to use the reported meaningful improvement of 5 or greater as a measure of success in this clinical trial. The GRC was collected at the sixth visit for every patient.

An 11-point NPRS (0, no pain; 10, worst imaginable pain) was used to measure pain intensity. The numeric pain scales have exhibited reliability and validity with a reported minimal clinically important difference of 2 points.[17,21-23] The LEFS is a lower extremity functional scale consisting of 20 questions, and the highest possible score is 80.[15] Higher scores indicate greater levels of function. The LEFS has been shown to have excellent validity, test-retest reliability, and responsiveness to change in patients with lower extremity disorders.[15,24,25]

The minimal clinically important difference for the LEFS has been reported to be 9 points.[15] Patients completed the NPRS and LEFS at either the eighth or the final visit.

Interventions

Participants received a maximum of 8 treatments over a time frame ranging from 3 to 8 weeks at a frequency of 1 to 2 sessions per week. The frequency and duration were selected based on clinical decision making of the therapist and patient availability. Treatment was directed to the triceps surae, soleus, plantar fascia, and medial calcaneal tubercle. Treatment was performed by initially scanning the area with light to moderate pressure until areas of fibrous adhesions were detected. Once the tissue had been localized, deeper pressure was applied for 1 to 2 minutes in the area of concern. The total treatment time was approximately 15 minutes for the GT. This was followed with 2 repetitions of static stretches directed at the triceps surae, soleus, and plantar fascia, which were held for 30 seconds each. Finally, ice was applied to the plantar surface of the foot for 15 to 20 minutes. Each

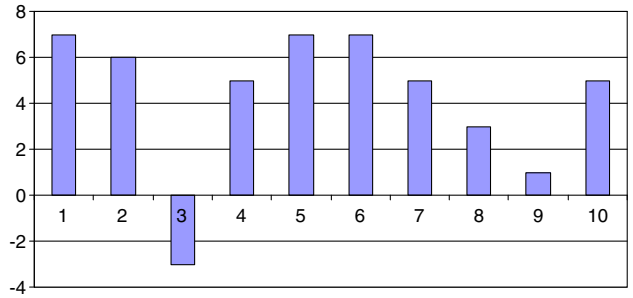

Fig 1. *The percentage of patients with successful and nonsuccessful outcomes.*

Table 1. *Baseline characteristics for each patient*

Subject	Sex	Duration of symptoms (wk)	Baseline lower extremity functional scale	Baseline pain scores
1	F	4	55	3
2	M	32	41	7
3	M	4	52	9
4	F	12	37	5
5	F	12	59	4
6	F	32	52	7
7	F	48	62	6
8	F	96	62	3
9	M	12	37	7
10	F	72	65	7

patient was instructed to perform the stretching program at home 3 times daily.

Data Analysis

Mean baseline demographic values were calculated for continuous variables. Frequencies were calculated for categorical variables. The number of successful outcomes on the GRC was examined using a binomial test. We also examined if there was a correlation between the duration of symptoms and the GRC scores using the Kendall τ rank correlation coefficient test. Dependent t tests were used to determine if a significant difference existed between pretreatment and posttreatment scores for the LEFS and NPRS. The Bonferroni correction was applied to account for the use of repeated t tests. The Bonferroni comparison using an adjusted α level equal to .05 was divided by the number of outcome measures. Therefore, $P < .025$ was necessary to be considered statistically significant. Data were analyzed with the SPSS package version 15.0 (SPSS Inc, Chicago, IL). $P < .05$ was considered statistically significant.

Results

Twelve patients with heel pain were screened for eligibility criteria. Two did not meet the eligibility criteria because one exhibited contraindications to manual therapy and the other had an LEFS score greater than 65. Of the 10 subjects who participated in this case series, 7 were female (70%), and the mean duration of symptoms was 32.4 weeks with an SD of 31.1 weeks (median, 22; range, 4-96). Patients were treated for an average of 6.9 (SD, 1.3) visits (median, 7.5; range, 5-8) over a 30.1-day (SD, 6.6) period (median, 28; range, 21-42). Based on our cutoff score for the GRC, 7 patients (70%) experienced a successful outcome. There was a statistically significant difference between the number of patients who did and did not achieve a successful outcome ($P = .047$). Figure 1 represents the percentage of both successful and nonsuccessful outcomes. Kendall τ rank correlation coefficient test did not show a significant correlation between the duration of symptoms and the GRC. The mean NPRS rating at baseline was 5.8 with an SD of 1.99 (median, 6.5; range, 3-9), and the LEFS was 52.2 with an SD of 10.5 (median, 53.5; range, 37-65).

The dependent t test for the NPRS showed that there was a significant improvement from baseline to follow-up for both the NPRS ($P = .002$) and LEFS ($P = .017$). Baseline characteristics for each patient can be found in Table 1. Baseline and follow-up scores as well as the difference between pretest and posttest values can be found in Table 2.

Discussion

To the best of our knowledge, this is the first report of patients with PF treated with GT. The group of patients selected for this case series treated with GT combined with a home stretching program experienced both a statistically significant and clinically meaningful improvement in all dependent measures. In addition, it has been reported that a GRC score of 5 or greater indicates a meaningful improvement[19] and was used as a cutoff for determining a successful outcome. In our case series, 7 of 10 patients surpassed this value, indicating that they exhibited perceived improvement in their condition since receiving GT in combination with a home stretching program. It should be recognized that 30% of the patients did not achieve this level, and within that, 10% reported significant worsening. The one case experiencing a worsening in status exhibited a large plantar calcaneal osteophyte upon imaging and also had a diagnosis on Parkinson disease. This suggests that there exists a subgroup of patients with PF who may respond to GT. Subgroups of patients who respond to different interventions have recently been gaining popularity in the literature. Future studies should begin to examine if this phenomenon exists with this population and the utilization of GT.

Recent research suggests that plantar "fasciitis" manifests itself as a noninflammatory degenerative process, and hence, the term *fasciosis* may be more appropriate.[26] Lemont et al[26] reviewed the histologic findings of 50 cases

Table 2. *Outcome assessment of each participant*

Subject	Initial pain scores	Follow-up pain scores	Change in pain scores	Initial LEFS	Follow-up LEFS	Change in functional scale	GRC scores
1	3	0	3	55	62	7	7
2	7	2	5	41	75	34	6
3	9	9	0	52	44	−8	3
4	5	2	3	37	46	29	5
5	4	0	4	59	76	17	7
6	7	0	7	52	63	11	7
7	6	4	2	62	64	2	5
8	3	2	1	62	70	8	3
9	7	6	1	37	51	14	1
10	7	2	5	65	73	8	5

of patients with PF. The findings revealed that none of the samples exhibited evidence of inflammation but rather degenerative changes in the fascia.[26] Perhaps this is the reason why corticosteroid injections have been found to be ineffective and, in fact, often result in serious side effects, including plantar fascia ruptures.[27,28] In addition, the biologic evidence that suggests that PF is not truly an inflammatory condition but one of fibrosis supports the theorized mechanism behind the GT. Perhaps the use of instruments allows the clinician to introduce a more controlled amount of microtrauma into an area of scar tissue or excessive fibrosis. Research suggests that the response of this microtrauma would augment the healing process by initiating inflammatory phase of healing and, ultimately, tissue remodeling through proper realignment of collagen fibers.[12,13]

Limitations

The limitations of this prospective case series design include the small group size and the fact that only short-term outcomes were collected. In addition, because there was no control group, a cause-and-effect relationship could not be determined. It is not certain whether GT or stretching or the combination of both contributed to the results. It is also possible that patients recovered naturally during the treatment period. However, it is not likely that spontaneous recovery occurred in 70% of the patients in this case series when they had been experiencing symptoms for a mean duration of 32 weeks. In addition, we included patients with plantar heel pain, but it is possible that they may have presented with a condition other than PF. Furthermore, we can not be certain if patients were compliant with their home stretching exercises. Future studies are necessary to examine the long-term improvements in pain and function. Furthermore, future studies in the form of randomized clinical trials combining GT with manual therapy and exercise to the commonly used conservative treatment approach of electrophysical agents and exercise would show which interventions are superior in the treatment of plantar heel pain.

Conclusion

To date, no studies have examined the effectiveness of GT and stretching for the management of PF. The result of the current cohort design showed that 70% of patients experienced a successful outcome. Overall, the 10 patients with PF treated in this case series with GT exhibited statistically significant and clinically meaningful improvements in pain and function. However, a cause-and-effect relationship can not be inferred from a cohort design. Future studies in the form of randomized clinical trials should investigate the effectiveness of GT for the management of plantar heel pain.

Practical Applications

- Graston Instrument Soft Tissue Mobilization technique (GT) is a commonly used management strategy for patients with PF.
- To date, no studies have investigated the effectiveness of GT for PF.
- Ten patients with PF treated with GT and home stretching exercises experienced clinically important improvements in pain and disability.
- Future studies in the form of randomized clinical trials are needed to further examine the effectiveness of GT in patients with PF.

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