Extracorporeal shockwave therapy for plantar heel pain: a survey of podiatrists in Aotearoa New Zealand

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Abstract

Background:

Plantar heel pain (PHP) is a common musculoskeletal problem affecting the foot, with numerous intrinsic and extrinsic risk factors. Management for PHP is multifactorial and consists of various interventions, including education, load management, exercise prescription, footwear and foot orthoses. Extracorporeal shockwave therapy (ESWT) has also been shown to be an effective treatment for people with PHP. Currently, there are no best practice guidelines on the application and implementation of ESWT for people with PHP, with little understanding of the use of ESWT in clinical practice. The aims of this study were: (1) to determine the prevalence of podiatrists using ESWT in Aotearoa, New Zealand; (2) to determine the decision-making process adopted by podiatrists in Aotearoa New Zealand when considering using ESWT for the treatment of PHP; and (3) to determine clinical protocols and machine settings that are used by podiatrists when implementing ESWT for PHP.

Methods:

A web-based survey was distributed to podiatrists in Aotearoa, New Zealand, through advertisements in professional body newsletters and private Facebook groups. Questions focused on the demographics of podiatrists that manage PHP and the clinical reasoning and protocols adopted when using EWST in the management of PHP Data obtained from the survey were analysed using descriptive statistics, and bar graphs were used to provide a visual presentation of the data. In addition, content analysis was used to analyse open-ended question responses.

Results:

Thirty participants completed the survey. Most participants treated PHP on a weekly basis, used ESWT in the management of PHP, and were based in private practice settings. Non-response to treatment and persistent symptoms were the most common reasons for using ESWT. Most participants used three or more treatments of ESWT. However, there was variation in the number of impulses, frequency of impulses and energy per impulse. Training in the use of ESWT was undertaken with peers, manufacturers or online. For participants that did not use ESWT, their clinical reasoning was based on the presence of acute symptoms, pain tolerance and/or success with other preferred interventions.

Conclusions:

Podiatrists in Aotearoa, New Zealand, use ESWT in the management of PHP in clinical practice. The clinical reasoning behind using ESWT in clinical practice is guided by the patient's persistent symptoms or a lack of success with frontline treatments for PHP. The clinical protocols for the use of ESWT vary between podiatrists. Future research may look at appropriate training methods that improve understanding of ESWT and promote its efficacy and safety when used by podiatrists in Aotearoa, New Zealand.

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Attestation of Authorship

‘I Keanu Laumatia-Paki hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning’

Name: Keanu Laumatia-Paki Date:21/12/22

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Chapter 1: Introduction

1.1 Introduction

PHP is a degenerative condition that affects the medial calcaneal tuberosity of the heel at the proximal insertion of the plantar fascia and affects 4-10% of the general population (Beeson, 2014; Riel et al., 2017). The plantar fascia works alongside the plantar intrinsic muscles to support the medial longitudinal arch of the foot and to provide stability to the foot via the windlass mechanism during the propulsive phase of gait (Farris et al., 2020). Activities such as walking, running and prolonged standing can place excessive load on the insertion of the plantar fascia at the plantar heel, leading to the development of PHP (Beeson, 2014).

Risk factors include age, obesity, abnormal biomechanics (reduced joint range of motion, excessively high or low arched foot type, abnormal gait patterns), occupation (prolonged standing) and training errors (over-training) and wearing inappropriate footwear (Beeson, 2014). PHP is typically diagnosed based on clinical findings (Morrissey et al., 2021). Symptomology of PHP includes first step morning pain, and pain at the heel after long periods of weight-bearing (Beeson, 2014). The inability to perform regular daily tasks for individuals can have a negative effect on health-related quality of life in people with PHP (Cotchett et al., 2020). Imaging features, associated with PHP include the calcification of the medical calcaneal tubercle (calcaneal “spur”) and thickening of the plantar fascia (>4mm) (Drake et al., 2022).

PHP management involves a range of interventions including education, load management, exercise prescription, footwear, foot orthoses, injection therapy and extracorporeal shockwave therapy (ESWT) (Morrissey et al., 2021). ESWT has been

used as a non-invasive form of treatment for people that do not respond to first line treatments, with data from clinical trials supporting its use in PHP (Morrissey et al., 2021).

Chapter 2: Literature review

2.1 Introduction

This literature review will discuss PHP, its associated risk factors, diagnosis, and management, followed by a summary of the literature relating to the use of ESWT as an intervention for people with PHP.

2.2 Prevalence of PHP

Plantar heel pain (PHP) is a common musculoskeletal pathology that affects athletic and non-athletic populations (Beeson, 2014; Cotchett et al., 2020). A survey of 5,109 adults over the age of 50 found the population prevalence for PHP was 10% (Thomas et al., 2019). In athletic populations, the prevalence of PHP ranges from 5-18%, making it one of the most common running-related injuries affecting the lower limb (Lopes et al., 2012). People with PHP commonly seek advice from health professionals with 12% of consultations relating to foot and ankle problems associated with PHP (Menz et al., 2010). One study in the United States estimated that 1,000,000 patient visits per year were attributed to PHP (Riddle & Schappert, 2004).

2.3 Impact of PHP

PHP is associated with reduced health-related quality of life (Cotchett et al., 2020; Palomo-López et al., 2018). A study of 100 people with PHP found that health-related quality of life was worse for females compared to males, with regards to foot pain, footwear, general health, physical activity, social capacity and vigour domains of the

Foot Health Status Questionnaire (Palomo-López et al., 2018). Difficulty performing weightbearing activities is a characteristic feature of PHP (Beeson, 2014). A study of 50 people with PHP found a moderate level of difficulty with work, hobbies, walking and running (Riddle et al., 2004). Qualitative work has also reported on the impact of PHP. A study by Cotchett et al. (2020) of 18 people with PHP found the condition had a negative impact on health-related quality of life, with themes of reduced physical activity, negative emotions and social isolation evident in participants.

2.4 Risk factors

2.4.1 Intrinsic risk factors

Body mass index (BMI) is the most frequently linked risk factor to PHP due to increased metabolic factors and load on the plantar fascia (Rogers et al., 2021). People with PHP have been found to have a higher BMI, greater waist girth and higher fat mass than those without PHP (Rogers et al., 2021). Increased age in athletic and non-athletic populations has also been identified as a risk factor for PHP (Beeson, 2014). In addition, lower limb biomechanical abnormalities such as a pronated foot type reduced muscle strength and reduced joint range of motion at the ankle joint, first metatarsophalangeal joint, and hamstrings have been linked to increases in plantar fascia strain (Beeson, 2014; Sullivan et al., 2015). Psychological factors have also been linked with PHP. A study of 36 people with PHP found that kinesiophobia and pain catastrophising were associated with worse first-step pain and foot function (Cotchett et al., 2017). Depression, anxiety and stress have also been independently associated with PHP (Cotchett et al., 2016).

2.4.2 Extrinsic Risk factors

Extrinsic risk factors relating to PHP are thought to be linked to increased load at the plantar heel (Beeson, 2014). Occupations involving prolonged standing or standing on hard surfaces are associated with PHP (Alvarez-Nemegyei & Negreros-Castillo, 2000). People with PHP have also been reported to stand more than twice as long as those without PHP (Landorf et el., 2022). Footwear can also increase loading at the heel, with harder-soled heels more commonly worn by people with PHP (Landorf et al., 2022). In athletic populations, training errors have also been linked to PHP (Beeson et al., 2014). In qualitative studies, these extrinsic risk factors have also been reported by people with PHP (Cotchett et al., 2020).

2.5 Diagnosis

PHP is typically diagnosed based on clinical findings, with key features including first-step pain, localised to the plantar-medial aspect of the heel and palpable at the origin of the plantar fascia (Morrissey et al., 2021). Imaging can rule out other pathology, such as calcaneal stress fractures or rupture of the plantar fascia (Draghi et al., 2017). Several characteristic findings have been reported in people with PHP. A recent systematic review reported imaging features commonly seen in people with PHP, including the presence of calcaneal spurs on x-ray, changes in echogenicity and thickening of the plantar fascia (>4mm) and plantar heel pad on ultrasound, and changes to tissue density and hyperaemia on magnetic resonance imaging (Drake et al., 2022).

2.6 Management of PHP

Due to the multifactorial nature of PHP, its management typically involves a range of interventions. A recent systematic review of clinical trials of interventions for PHP proposed a core approach to managing this condition (Morrissey et al., 2021). The core approach comprised stretching, education and taping for all people with PHP, with load management, pain education, footwear and addressing long-term conditions based on individual assessment (Morrissey et al., 2021). For those that fail to respond to these front-line treatments for PHP, ESWT, custom foot orthoses and injection therapy are advocated as adjunct interventions after four weeks (Morrissey et al., 2021). Of these interventions, there appears to be a stronger body of evidence for using ESWT.

2.7 Extracorporeal shockwave therapy (ESWT)

ESWT was first developed to treat kidney stones in the 1980s and is now used to treat various musculoskeletal conditions, including PHP (Ko & Wang, 2018). The understanding surrounding the mechanism of action for ESWT has yet to be clearly defined. However, it is believed to work by stimulating neovascularisation and interrupting pain pathways to focus on the injured site by creating high- and low-energy acoustic soundwaves (Sun et al., 2017; Wang, 2012). These soundwaves direct energy to target tissues through impulses (shocks) delivered at a high frequency (Sun et al., 2017). The delivery of energy to pathological tissues through ESWT can help to stimulate neovascularisation and collagen synthesis (Hsu et al., 2004). ESWT also promotes an initial increase in substance P (neurotransmitter of pain perception), and a decrease quickly follows that in substance P through the degeneration of nerve endings

(Maier et al., 2003). Specific to the plantar fascia, ESWT has been shown to reduce plantar fascia thickness in people with PHP (Hocaoglu et al., 2017). The reasons for these changes at the plantar fascia are not yet known.

2.7.1 Focused and radial ESWT

The application of ESWT can be performed using focused-ESWT or radial-ESWT (Sun et al., 2017). Focused-ESWT delivers energy to a focused point that penetrates the superficial layer of the skin to target deeper tissue (Lohrer et al., 2010). Radial-ESWT also delivers energy. However, it targets the superficial skin surface so that energy can be distributed radially from this point into tissue (Sun et al., 2017). Both focused-ESWT and radial-ESWT are beneficial in treating PHP (Rompe et al., 2003; Speed et al., 2003). In addition, systematic reviews have suggested that focused-ESWT performs better than radial-EWST compared to sham treatments. However, sound conclusions regarding whether focused-ESWT is better than radial-ESWT still need to be made (Sun et al., 2017).

2.8 ESWT for acute PHP

The use of ESWT for people with acute presentations of PHP has been reported. One randomised clinical trial compared the effectiveness of specific plantar fascia stretching against radial-ESWT for initial treatment for acute PHP (Rompe et al., 2010). The inclusion criteria for this study were PHP symptoms for less than 6-weeks, pain rating of ≥6 on the Numeric Rating Scale (0-10) and palpable pain at the proximal plantar fascia. Participants were excluded if they had received treatment for their PHP. One

hundred and two participants were randomly allocated to receive either an eight-week specific plantar fascia stretching program or radial-ESWT delivered over three treatment sessions (2000 shockwaves pulses at the energy level of 320mJ/mm2). The Foot Function Index was used to assess foot pain at two-, four- and fifteen-months. Both groups reported an improvement in symptoms of acute heel pain; however, significant improvements were seen in the stretching group compared to the radial-ESWT group at two- and four- months. This highlights that stretching may be a more effective treatment during acute presentations of PHP. Further to this, the authors also emphasised that stretching requires no equipment and can be easily performed daily.

2.9 ESWT for chronic PHP

Several trials have investigated the effectiveness of ESWT for chronic PHP, with contrasting results. For example, Buchbinder et al. (2002) conducted a randomised control trial involving 166 participants with PHP symptoms for more than six weeks and plantar fascia thickening greater than 4mm. Participants were randomly assigned to an intervention group that received ultrasound-guided ESWT (2000 to 2500 shock waves at an energy level ranging from 0.2-0.33mJ/mm2) or a control group that received ultrasound-guided ESWT of a lower frequency and energy (100 shock waves at an energy level of 0.02mJ/mm2). Both groups were given three treatments over three weeks and followed up at 6- and 12-weeks. The primary outcomes were pain (overall pain, morning pain and activity pain), walking ability, disability (Maryland Foot Score), health status (Short-Form -36) and perceived importance of problems (Problem Elicitation Technique). At 6- and 12-weeks, both groups showed improvements across all outcomes. However, there were no differences between groups which does not

conclusively support using ESWT. The authors suggested that this might be due to a placebo effect and the self-limiting natural history of heel pain, where symptoms can improve overtime without treatment.

Another randomised controlled trial by Rompe et al. (2003) investigated the effects of focused-ESWT in runners with chronic PHP. All participants had moderate to severe PHP symptoms for over 12-months, localised to the tuberosity of the calcaneus. The intervention group (n=22) received 6300 shocks over three treatment sessions (energy 0.16mJ/mm2). The control group (n=23) also received 6300 shocks over three treatment sessions; however, a sound-reflecting device was placed between the treatment probe and the heel to create the illusion of pulses to the foot. The primary outcome was pain on the first step in the morning (10cm VAS) assessed at baseline, 6- and 12-months. Significant between-group differences were seen at 6- and 12-months in the intervention group. At 6-months, 60% of the intervention group showed a 50% reduction in symptoms, whereas 27% of the control group reported the same improvements. At 12-months, the percentage of participants reporting a 50% reduction in pain was 72% for the intervention group and 35% for the control group.

Speed et al. (2003) evaluated the effects of moderate dose focused-ESWT for people with PHP. Eighty-eight people with PHP symptoms over three months were randomly allocated to an intervention group (focused-ESWT of 1500 pulses at 0.12mJ/mm2) or a control group (sham focused-ESWT of minimal pulses at 0.04mJ/mm2). Participants received three treatments per month, over a three-month period. The pain was the primary outcome assessed at baseline, three- and six-months using a 100mm VAS (day pain, night pain, first-step pain). Significant within-group improvements were seen at all follow-up periods for both groups; however, no between-group differences were

observed over the six-months. The authors suggested that the frequency of treatments received by the control group may have further enhanced the placebo effect.

Another randomised trial of 246 participants was conducted to explore the effectiveness of focused-ESWT on chronic PHP (Gollwitzer et al., 2015). The inclusion criteria of this study were six-months of PHP (based on the American College of Foot and Ankle Surgeons clinical practice guidelines) with previous failed treatments that were not ESWT, first step morning pain, pain through daily activities and pain with pressure ≥5/10 on 10cm VAS, and fair to poor pain and disability based on the Roles and Maudsley score. Participants were allocated to an intervention group (n=126) receiving 2000 shocks at an energy level of 0.01 to 0.25mJ/mm2 or a control group (n=124) receiving a sham intervention where shock waves were air-filled to prevent pulses from being transmitted to the heel. A total of three sessions were performed with weekly intervals in between, with outcomes assessed at baseline and twelve weeks after the final treatment. The primary outcome measure was pain (assessed on a 100mm VAS) before and after treatment, morning first step pain, pain when applying localised pressure to the heel and pain during daily activities. Again, a significant difference between groups was observed, with 69.2% of the intervention group reporting a reduction in pain compared to 34.5 % in the control group, proving ESWT to be a superior form of therapy with a 50 to 60mm reduction in heel pain.

Hocaoglu et al. (2017) compared ESWT to ultrasound-guided local cortisone injection in people with chronic PHP. Seventy-two patients with plantar heel pain were randomised to receive either radial-ESWT (2,000 shockwaves, 10-Hz frequency, 0.16mJ/mm2) for three sessions, one-week apart (n=36) or ultrasound-guided corticosteroid injection (1mL betamethasone sodium plus 0.5mL prilocaine) (n=36).

The inclusion criteria were local tenderness at the medial tubercle of the calcaneus, morning pain, long periods of walking/standing, plantar fascia thickness ≥4mm on ultrasound, and those non-responsive to other treatments for more than 6-months. Primary outcomes measured were pain (100mm VAS), Foot Function Index (pain, disability, activity limitation). Secondary outcomes included heel tenderness on palpation (four-point Likert) and plantar fascia thickness (ultrasound). Outcomes were measured at one-, three- and six-months post-treatment. Statistically significant improvements in pain were noted at one-month for both groups. However, three- and six-month improvements were only observed in the radial-ESWT group. Foot Function Index scores were also improved at one- and three-months in both groups. However, improvements were also seen at six-months in the radial-ESWT group. The authors concluded that the use of ESWT and corticosteroid injections are favourable treatments for chronic PHP. However, ESWT may be preferred due to its effectiveness and treatment safety. Although cortisone injections had produced a more rapid reduction in pain, the pain slowly returned in the following months. A limitation of this study was that the authors only reported within-group differences, and despite the recommendations regarding safety, adverse events were also not reported.

2.10 Adverse events

The complications associated with ESWT for PHP are typically limited to localised pain during and shortly after treatment, as well as redness and swelling (Ogden, 2004). One systematic review investigated the side effects of ESWT in 1,946 patients and found that 21% of patients experienced adverse events (Roerdink et al., 2017). These were typically pain during treatment (11%) and skin irritation post-treatment (11%).

Dysesthesia, swelling, and pain >1-week post-treatment were seen in less than 1% of people. These complications were also unlikely to be present one-year following treatment, suggesting that ESWT is a safe treatment. An initial increase in substance P is also seen with ESWT (Maier et al., 2003), which may help to explain the initial pain at the time of receiving ESWT, followed by the improvements post-treatment. Interestingly, the use of local anaesthetic prior to ESWT has been shown to reduce the treatment effect of ESWT (Rompe et al., 2005). This suggests that ESWT may not be appropriate in all presentations of chronic PHP and that the overall treatment load (impulses, energy, frequency) may be a factor where patients report the pain.

2.11 Discussion of findings relating to the use of ESWT for PHP

ESWT is an effective treatment for people with PHP, although it may be more beneficial in more established presentations. However, Rompe et al. (2010) found that stretching was superior to ESWT in the acute presentation of PHP, suggesting that ESWT is not an appropriate treatment when symptoms have been present for less than six weeks. This finding is consistent with current best practice guidelines (Morrissey et al., 2021) that suggest ESWT is indicated for cases that fail to respond to core treatment strategies, such as stretching. Additionally, failure to respond to treatment is likely to extend beyond the acute phases of PHP.

There appears to be more substantial evidence supporting the use of ESWT for chronic PHP. Gollwitzer et al. (2015) and Rompe et al. (2003) showed similar improvements, with both intervention groups demonstrating over 60% improvement compared to the sham treatment, which was below 40%. The improvements in the sham groups may be

due to the observations from previous trials that demonstrate that people with PHP symptoms can improve over time (Atkins et al., 1999). The greater improvements in those who have received ESWT suggest it has a role to play in treating chronic PHP. It was evident through the studies that the reasons for participant withdrawal needed to be better reported. This could be due to issues in tolerating ESWT at higher energy levels and the pain associated with this treatment. ESWT also performed better than cortisone injections long-term (Hocaoglu et al., 2017). An extensive systematic review found cortisone injections benefit PHP compared to other treatments, although ESWT was not included as a comparator treatment (Whittaker et al., 2019). Importantly, cortisone injections were less effective than placebo injections (Whittaker et al., 2019). Overall, this suggests that ESWT may be the preferred treatment in cases that do not respond to initial treatment.

An important finding to highlight in the studies identified is the improvements in PHP symptoms seen in those that received a sham treatment. This suggests a placebo effect as the improvements in control groups were not significantly different from those that had received ESWT (Buchbinder et al., 2002; Rompe et al., 2010). This is supported by a systematic review of 11 randomised clinical trials that found that in 10 of the trials, improvements were seen in the control group that had not received treatment (Atkins et al., 1999).

2.12 Gaps in the literature

There is a growing body of evidence supporting using ESWT to manage PHP. However, its use in clinical practice is not known. Other interventions, such as foot

orthoses, are used by 92-100% of podiatrists to manage PHP (Chapman et al., 2018). To the researcher's knowledge, no data has investigated the use of ESWT by clinicians. Clinical practice guidelines have advocated using ESWT in managing PHP alongside a range of other interventions. However, the decision-making processes used by clinicians for the use of ESWT in the management of PHP are not known. Clinical trials of ESWT show variation in the protocols adopted, including equipment used (radial versus focused-EWST), machine settings (number of impulses, energy delivered, frequency), number of treatment sessions and outcomes measured. It is not known what protocols clinicians use when implementing ESWT in clinical practice.

2.13 Conclusion

ESWT is an effective treatment for established presentations of PHP. The use of ESWT in acute presentations is not supported. Several clinical trials' findings demonstrate improvement in using ESWT compared to placebo interventions. Minimal adverse effects were reported through studies, suggesting that ESWT is a safe treatment for PHP.

Chapter 3: Aims

3.1 Aims

1) To determine the prevalence of podiatrists using extracorporeal shockwave therapy (ESWT) for the treatment of plantar heel pain (PHP) in Aotearoa New Zealand

(2) To determine the decision-making process adopted by podiatrists in Aotearoa New Zealand when considering using ESWT for the treatment of PHP

(3) To determine clinical protocols and machine settings used by podiatrists in Aotearoa New Zealand when using ESWT for with the treatment of PHP

Chapter 4: Methodology

4.1 Introduction

This chapter will outline the process undertaken for the survey.

4.2 Study design

This study was a cross-sectional, observational survey.

4.3 Ethical approval

This study was approved by the Auckland University of Technology Ethics Committee (reference number 22/264) (**Appendix 1**).

4.3 Inclusion criteria

The inclusion criteria for this study were:

1. Podiatrists registered with the Podiatrists Board of New Zealand
2. Holding an Annual Practising Certificate with the Podiatrists Board of New Zealand

4.4 Survey development

The reporting of this section will adhere to the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (Eysenbach, 2004).

4.4.1 Survey design

This study used an anonymous online survey.

4.4.2 Ethical approval and informed consent process

4.4.2.1 Ethical approval

This study was approved by the AUT Ethics Committee (AUTEC) (**Appendix 1**).

4.4.2.2 Informed consent

All participants were fully informed of the purpose and nature of the study before completing the questionnaire (via the 'participant information page' displayed at the start of the questionnaire). Consent was obtained from all participants by clicking a "consent" button that would open the survey questions.

4.4.2.3 Data protection

No personal information was collected by the researchers, including information that would potentially identify the participant and the IP address from which the participant completed the survey from. All data was collected and stored by Qualtrics XM (Provo, UT), an online survey platform. Only the research team had access to the survey and survey responses.

4.4.3 Development and pre-testing

4.4.3.1 Development and testing

The questions in the survey were developed in consultations with podiatrists in Aotearoa, New Zealand, who have experience in using ESWT. The survey was piloted by 3 Podiatrists in Auckland New Zealand, prior to being distributed.

4.4.4 Recruitment process and description of sample

4.4.4.1 Open vs closed survey

This was an open survey sent to registered podiatrists in Aotearoa New Zealand, with no password protection to access the survey.

4.4.4.2 Contact mode

Contact with potential participants was made through two online advertisements containing a link to the survey. These advertisements were posted to potential participants via a Podiatry New Zealand Newsletter and an online post to the 'NZ Podiatry Alumni' private Facebook group. The researchers had no direct contact with potential participants.

4.4.4.3 Advertising the survey

Advertisement included Podiatry NZ monthly newsletter (**Appendix 2**) and published on advertisement in the NZ Podiatry Facebook group page (**Appendix 3**). This

advertisement introduced the research team, explained the voluntary nature of the survey and outlined that it would contribute to the award of an academic qualification.

4.4.5 Survey administration

4.4.5.1 Web/email

This web-based survey was conducted using Qualtrics (Qualtrics, Provo, UT), a web-based survey platform, where participants manually entered responses to the survey questions (**Appendix 4**).

4.4.5.2 Context

Potential participants were invited to participate through a study advertisement included in a Podiatry NZ monthly newsletter and published on advertisement in the NZ Podiatry Facebook group page.

4.4.5.3 Mandatory/voluntary

The survey was voluntary, where participants could choose to partake in the survey.

4.4.5.4 Incentives

Participants were informed prior to consenting to complete the survey that they could choose to enter a prize draw to win a NZ$100 Westfield voucher. After completing the survey, participants were invited to partake in another survey to enter the prize draw. Participants that wanted to enter the prize draw followed a separate link to the prize

draw survey, where they entered their contact details (Appendix 5). Having a separate survey meant that survey responses could not be linked to participant's contact details.

4.4.5.5 Time/date

The survey was open between 13th October 2022 and 20th November 2022.

4.4.5.6 Randomisation of items or questionnaires

Due to the nature of this survey, which included the use of adaptive questioning, randomisation of items was not part of the survey.

4.4.5.7 Adaptive questioning

This survey used adaptive questioning, where relevant survey items were displayed based on participant's responses.

4.4.5.8 Number of items

In total there were 24 potential items in this survey. After consenting participants were directed to the demographic information page where they completed seven questions. Depending on the response to final question of the demographic information page, participants would be directed to either a clinical reasoning page where they completed four questions, or a clinical reasoning for not using ESWT page where the completed up to two questions. Participants that indicated that they used ESWT themselves, were

directed towards the clinical protocols for the use of ESWT page where they completed eleven questions.

4.4.5.9 Number of screens (pages)

The survey was distributed over five pages.

1. Participant information (consent)
2. Demographic information (seven questions)
3. Clinical reasoning for the use of ESWT (four questions)
4. Clinical protocols for the use of ESWT (eleven questions)
5. Clinical reasoning for not using ESWT (two questions)

The pages shown to participants was dependent on their responses to the survey questions.

4.4.5.10 Completeness check

All survey items were deemed to be mandatory, with participants prompted to complete outstanding items before being able to progress to the subsequent survey page.

4.4.5.11 Review step

Participants were not able to review or change answers once the survey was completed.

4.4.6 Response rates

4.4.6.1 Unique site visitor

Internet Protocol (IP) addresses of participants were not recorded, so visitors to the survey were not recorded.

4.4.6.2. View rate

View rate was defined as the number of unique survey site visitors that viewed the first page of the survey divided by the number of unique site visitors to the survey page. As IP addresses were not recorded the view rate was not able to be calculated.

4.4.6.3 Participation rate

Participation rate was defined as the number of participants that consented to participate divided by the number of unique site visitors to the survey page. As IP addresses were not recorded the participation rate was not able to be calculated.

4.4.6.4 Completion rate

Completion rate was defined as the number of participants that completed the survey divided by the number of participants that consented to participate in the survey.

4.4.7 Preventing multiple entries from the same individual

4.4.7.1 Cookies used

Cookies were not used to assign a unique identifier to each computer. All survey responses were included in the analysis.

4.4.7.2 IP check

IP addresses were not recorded to identify users.

4.4.7.3 Log file analysis

Log file analysis was not used to identify if participants had submitted multiple survey responses.

4.4.7.4 Registration

This survey used an open design where participants were not required to login to access or partake in the survey.

4.5 Data analysis

4.5.1 Handling of incomplete questionnaires

Only completed questionnaires were included in the analysis. All data from the survey was analysed using Qualtrics Reports (Qualtrics, Provo, UT). Descriptive statistics were reported with categorical variables presented as n (%) and continuous variables as mean (SD). Bar graphs were used to provide a visual presentation of the data. Content

analysis was used to analyse open-ended question responses, including frequency counting of common phrases/themes.

4.5.2 Questionnaires submitted with an atypical timestamp

No time restrictions were placed on completing any items of the survey.

4.5.3 Statistical correction

No weighting of items was used in this survey.

Chapter 5: Results

5.1 Introduction

This chapter will present the results of the survey.

5.2 Response rates

Thirty-one participants consented to complete the survey. One participant consented but did not answer any additional questions. In total, 30 participants completed the survey, indicating a completion rate of 97%. Participants were not required to register their details to complete the survey, so the number of unique site visitors, view rates and participation rates could not be calculated.

5.3 Participant demographics

Thirty participants completed the participant demographic questions. Data relating to the number of years registered is shown in **Figure 5.1.** Forty-three percent of participants (n=13) declared being registered for less than 5 years, 23% of participants (n=7) declared being registered between 5-10 years, 10% of participants (n=3) declared being registered between 10-15 years, with 23% (n=7) declared being registered greater than 15 years.

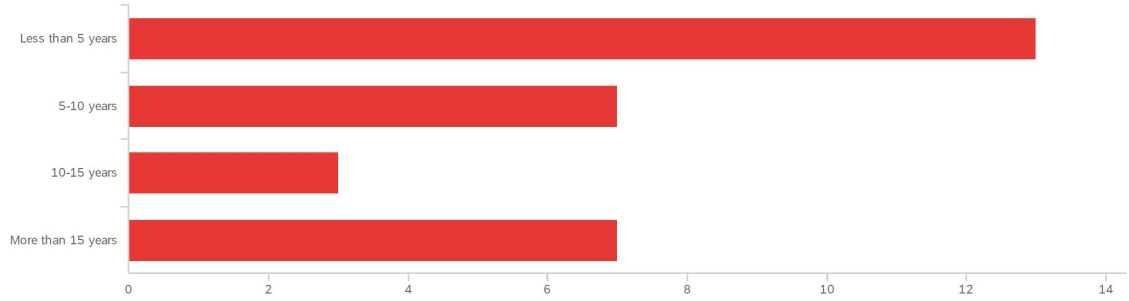


Figure 5.1 Number of years as a registered podiatrist

Data relating to age is shown in **Figure 5.2**. The majority of participants were under the age of 40 years, with 40% (n=12) aged 20-29 years and 33% (n=10) aged 30-39 years. Five participants (17%) were aged 40-49 years, 2 (7%) participants were aged 50-59 years, with 1 participant aged 60+ years (3%).

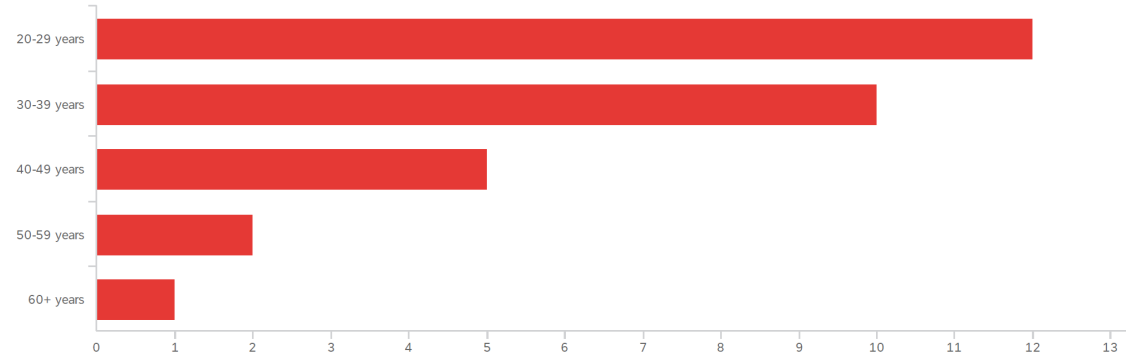


Figure 5.2 Age of participants

Data relating to formal qualifications is shown in **Figure 5.3**. The majority of participants (73%) held a Bachelors-level qualification (n=22), with 8 participants

(27%) holding postgraduate qualifications (postgraduate certificate/diploma n=5, Masters degree n=3).

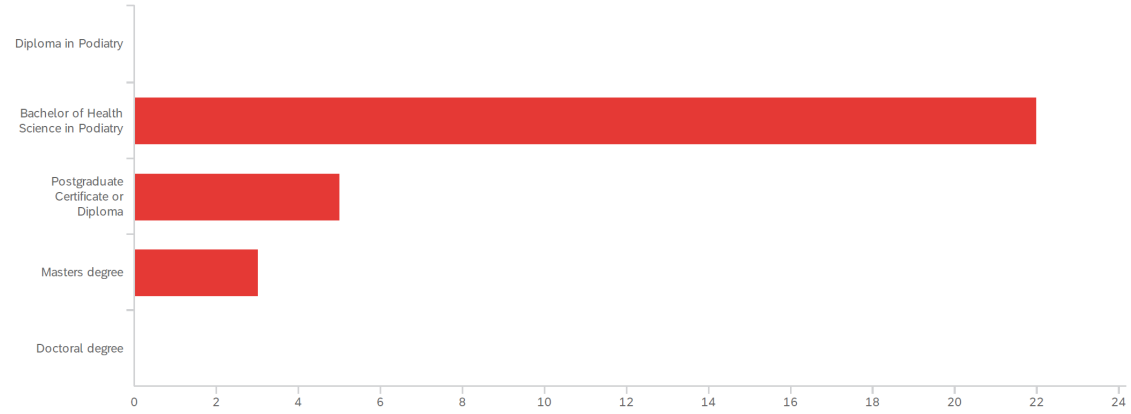


Figure 5.3 Highest qualification

Data relating to workplace setting is shown in **Figure 5.4**. Ninety-three percent of participants were in private practice (n=28), with 7% of participants working within education (n=2).

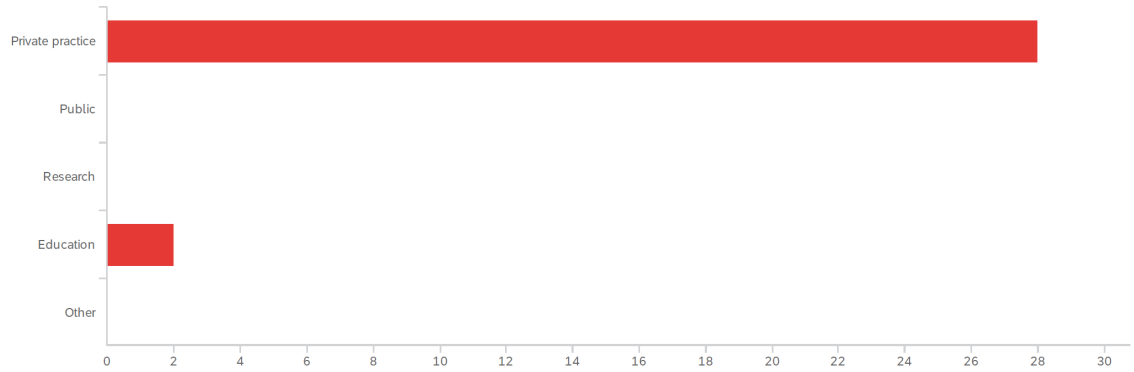


Figure 5.4 Workplace setting

Data relating to the number of plantar heel pain (PHP) cases treated per week is shown in **Figure 5.5**. Twenty percent (n=6) of participants indicated that they treat 1-2 patients with PHP per week, 27% (n=8) indicated that they treat 3-5 patients with PHP per week, 33% (n=10) indicated that they treat 6-10 patients with PHP per week, 17% (n=5) indicated that they treat more than 10 patients with PHP per week, with 1 participant indicating that they treat 0 patients with PHP per week.

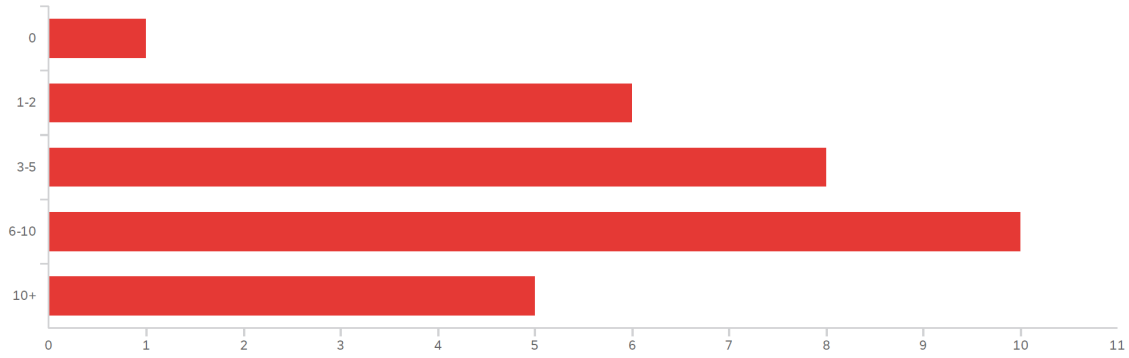
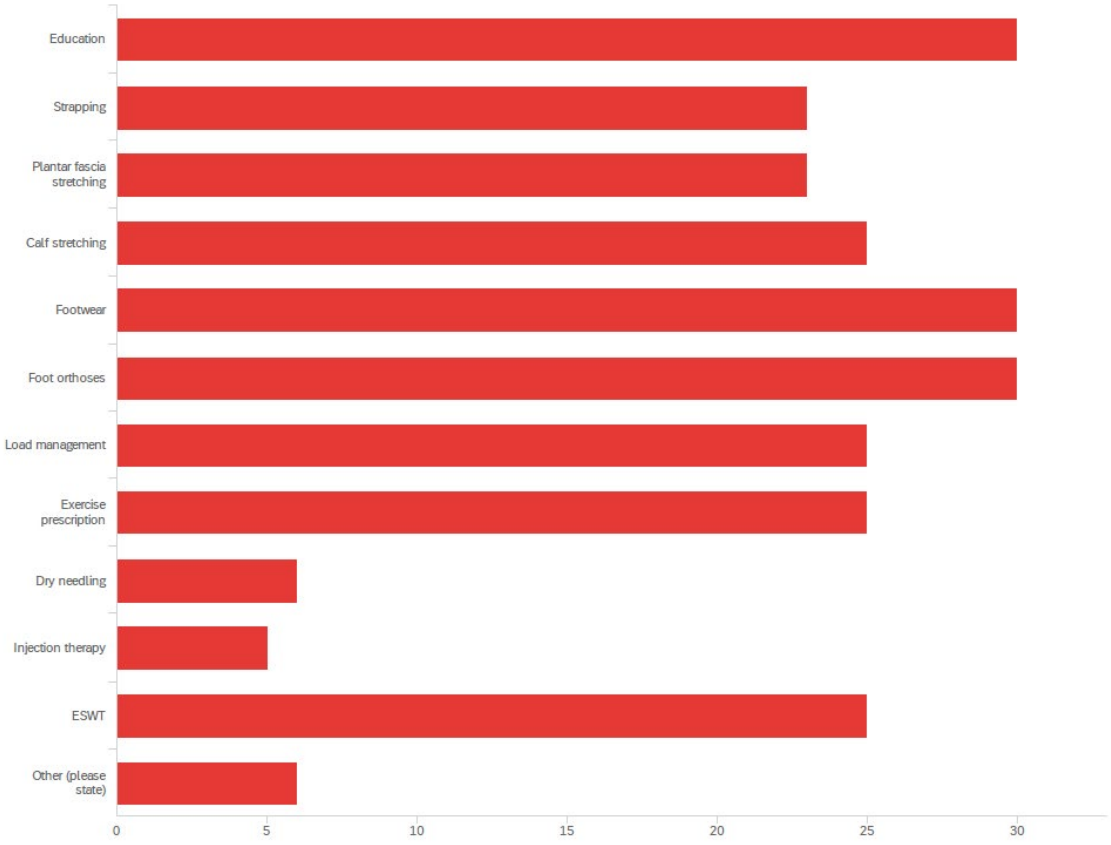


Figure 5.5 Number of plantar heel pain cases treated per week

Data relating to interventions used in the management of PHP is shown in **Figure 5.6.** Participants used a range of interventions in the management of PHP, with all participants (n=30) indicating that education, footwear and foot orthoses formed part of management. Eighty-three percent (n=25) indicated that calf stretching, load management, exercise prescription and Extracorporeal Shockwave Therapy (ESWT) were used in the management of PHP, with 77% of participants (n=23) indicating that strapping and plantar fascia stretching formed part of their management of PHP. Less commonly used interventions included dry needling which was used by 20% of participants (n=6). Six participants indicated that they used other interventions which

included (night socks (n=1), night splints (n=1), manual therapy (n=1), PRP injections (n=1), icing (n=1) and referral to other health professionals (n=1).



Other (please state)
Night socks and compression hosery
Manual Therapy
PIT - Perineural injection therapy. PRP injections,
Night splints
Icing
Referral to involve other appropriate health practitioners

Figure 5.6 Interventions used in the management of PHP

Data relating to the use of ESWT in the management of PHP is shown in **Figure 5.7**. Ninety percent of participants indicated that they use ESWT in their clinical practice (n=23, 77%) or refer patients to other providers (n=4 (13%), with 10% of participants (n=3) not using ESWT as part of their clinical practice for the management of PHP. Of the three participants that did not use ESWT, 67% (n=2) did not have access to ESWT with 33% (n=1) indicating that ESWT is not an effective treatment for PHP (**Figure 5.8**). The one participant that indicated that ESWT was not an effective treatment indicated that patients did not benefit from the treatment **(Figure 5.9**).

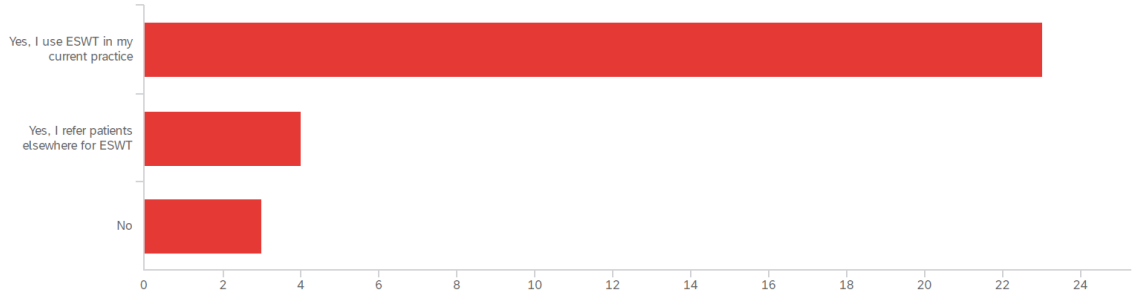


Figure 5.7 Use of ESWT in the management of PHP

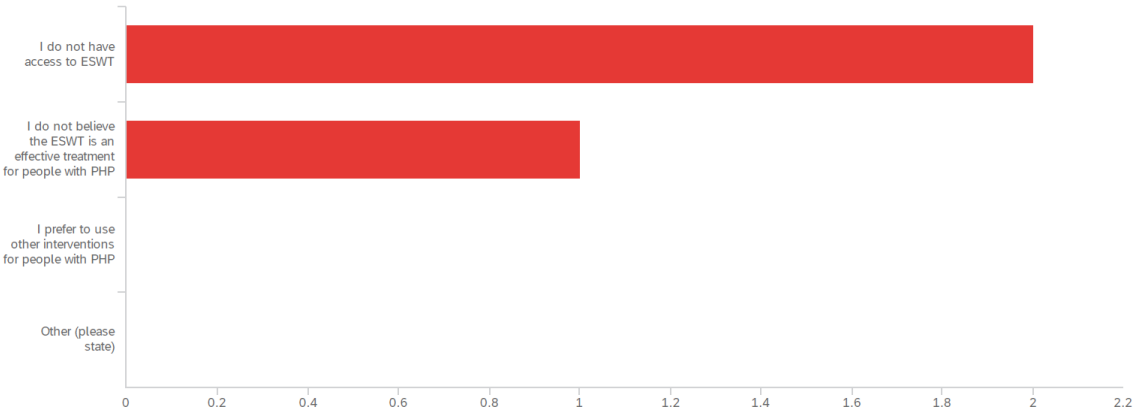


Figure 5.8 Reasons for not using ESWT

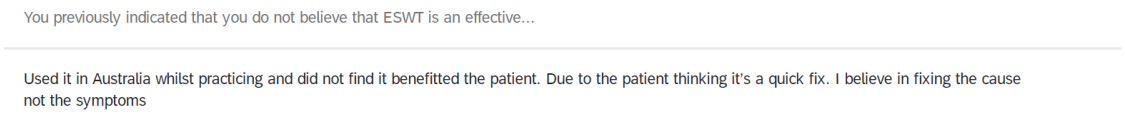


Figure 5.9 Reasons for not believing ESWT is effective

5.4 Clinical reasoning for the use of ESWT

Twenty-seven participants completed the clinical reasoning questions. Data relating to the decision to use ESWT for people with PHP is show in **Figure 5.10**. Eighty-seven percent (n=26) indicated that they used ESWT when patients did not respond to other treatments, with 73% (n=22) indicating that they used ESWT in patients with non-resolving, persistent symptoms. Ten percent (n=3) of participants indicated that the presence of acute symptoms guided their use of ESWT. Three participants cited other reasons for using ESWT including chronic PHP (n=1), plantar fascial hypertrophy (thickening) (n=1) and the use of other interventions (n=1) as factors guiding the use of ESWT.

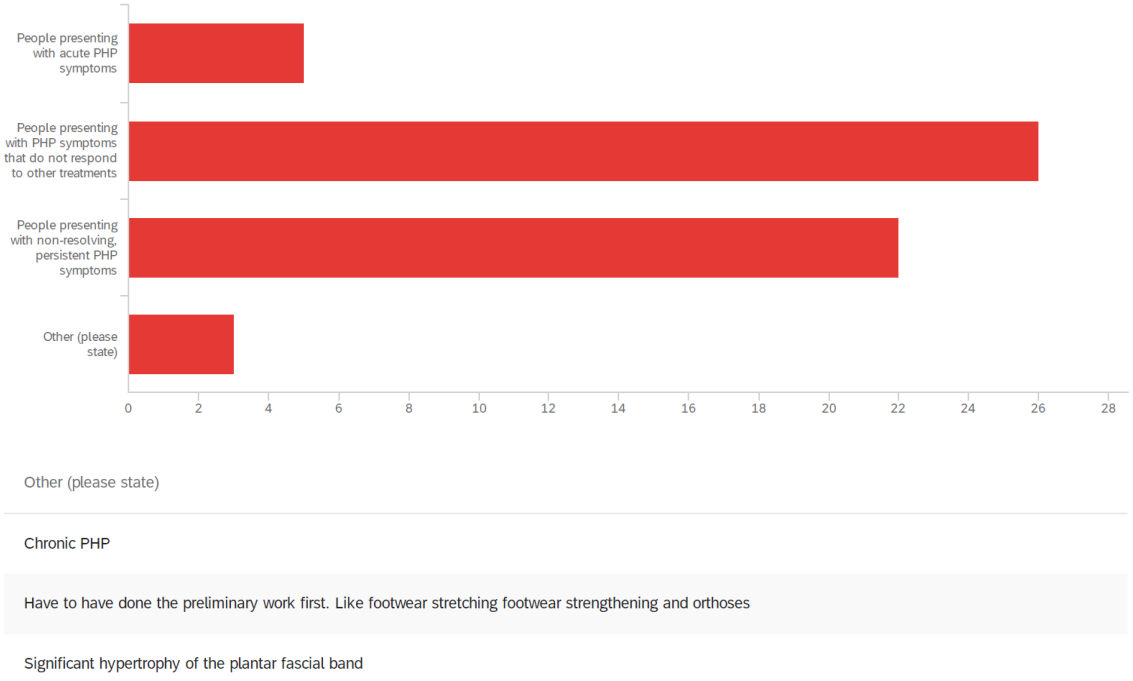
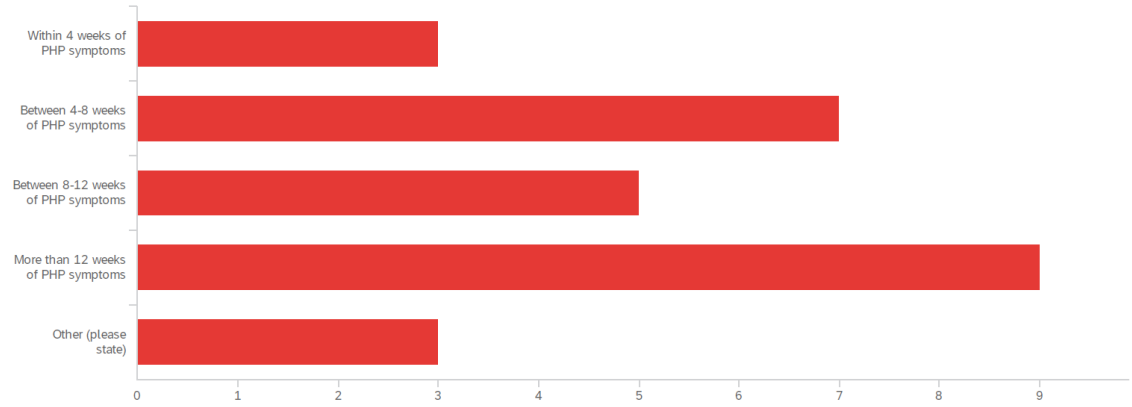


Figure 5.10 Decision to use ESWT for people with PHP

Data relating to the duration of symptoms before considering the use of ESWT for patients with PHP is shown in **Figure 5.11**. Eleven percent of participants (n=3) indicated that they considered using ESWT within 4 weeks of symptoms, 26% (n=7) between 4-8 weeks from symptom onset, 19% (n=5) between 8-12 weeks from symptom onset and 33% (n=9) after 12 weeks from symptom onset. Eleven percent (n=3) of participants cited other timeframes including chronic symptoms (n=1), greater than six months (n=1) and response to other treatments (n=1).



Other (please state)

It has to be chronic not accute

more than 6 months

Really depends on the severity and location of pain and whether other treatment modalities have already already been pursued by patient/other practitioner. Although typically around 8 weeks.

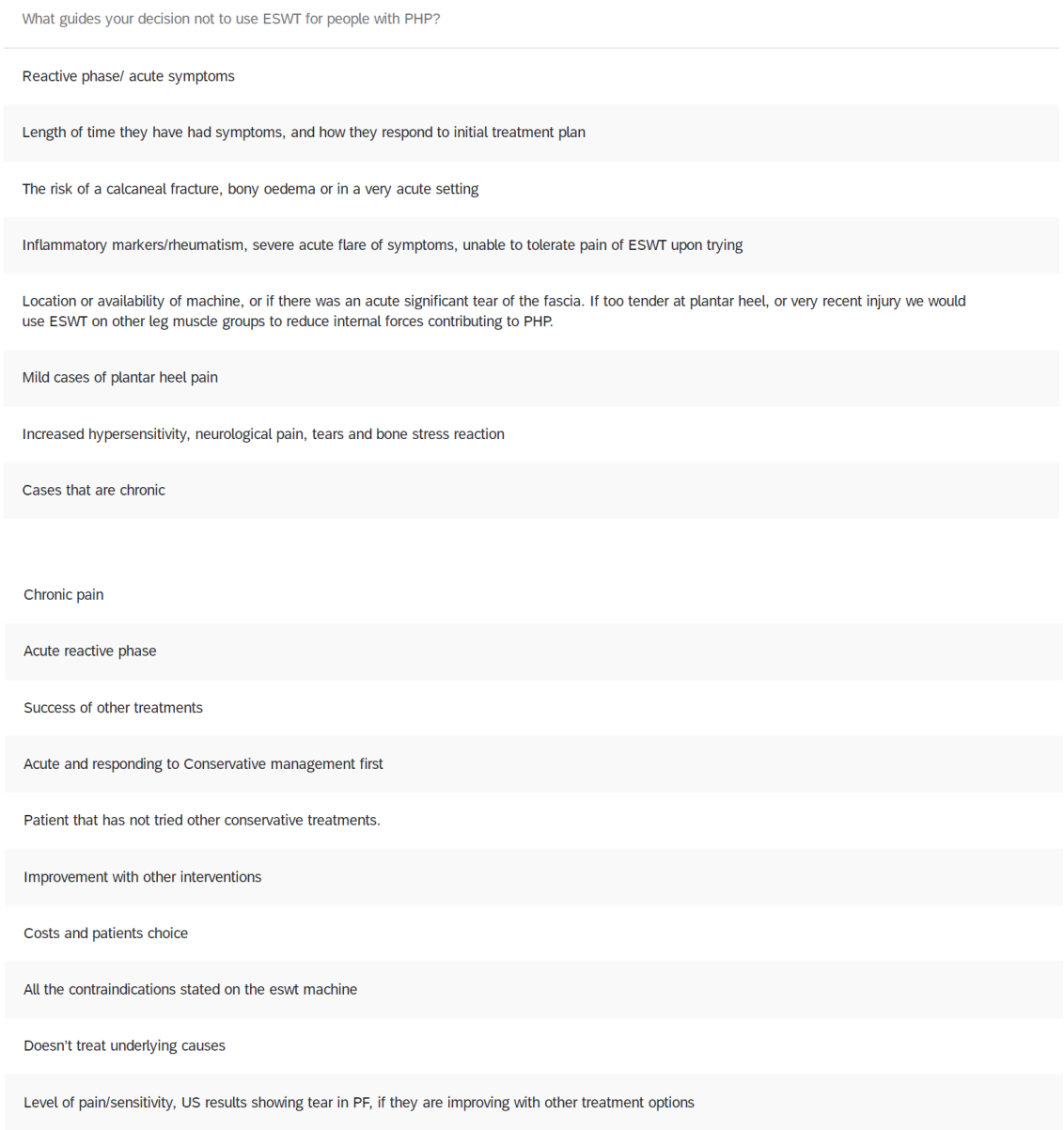
Figure 5.11 Duration of symptoms before considering the use of ESWT for people with PHP

Data relating to the percentage of patients with PHP treated with ESWT is shown in **Figure 5.12**. The mean (SD) percentage of patients receiving ESWT was 46 (24) patients, with percentages ranging from 5% to 95% of patients treated for PHP.

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	% of people PHP that you use ESWT for	5.00	95.00	45.89	23.97	574.54	27

Figure 5.12 Percentage of people with PHP treated that receive ESWT

Data relating to decisions not to use ESWT for people with PHP is shown in **Figure 5.13**. A total of 29 open-ended responses were received with 11 participants citing acute symptoms, 9 participants citing treatment success with other interventions, 6 participants citing contraindications, 5 participants cited pain tolerance/threshold and 3 participants citing chronic symptoms as reasons for not using ESWT.



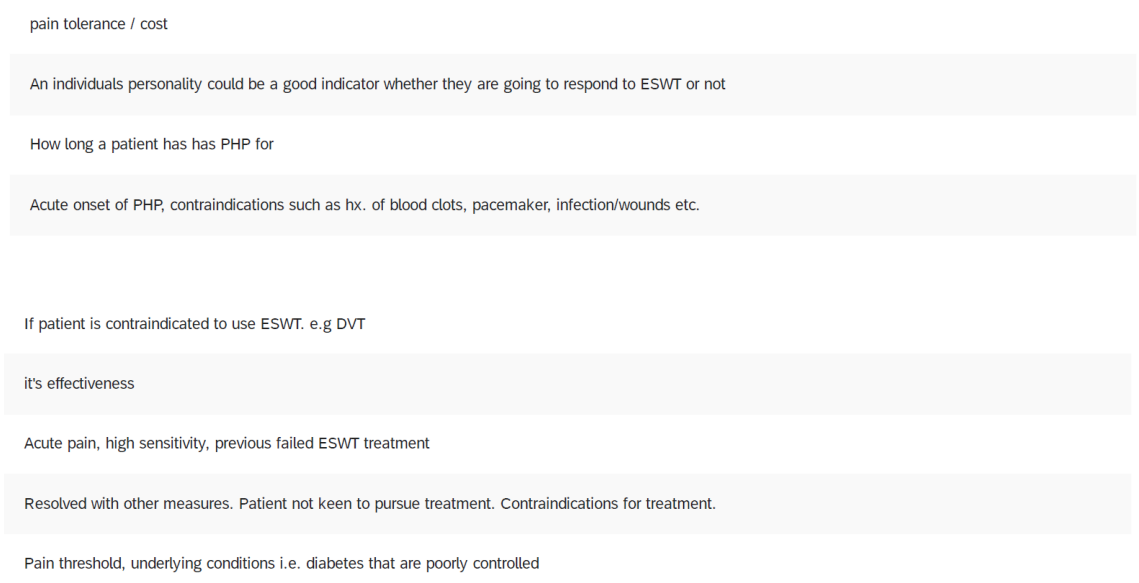


Figure 5.13 Factors guiding the decision not to use ESWT for people with PHP

5.4 Clinical protocols for the use of ESWT

Twenty-three participants completed the clinical protocols questions. Data relating to the brand/model of ESWT machine is shown in **Figure 5.14**. The most used brand of machine was Chattanooga (52%, n=12), with 26% of participants using either a DJO (n=2), Allcare (n=2) or Longest (n=2) machine. The remaining participants used Storz MP200 (n=1), German (n=1), Surgical Supplies (n=1), or Stork (n=1) machines, with one participant unsure of the brand/model used.

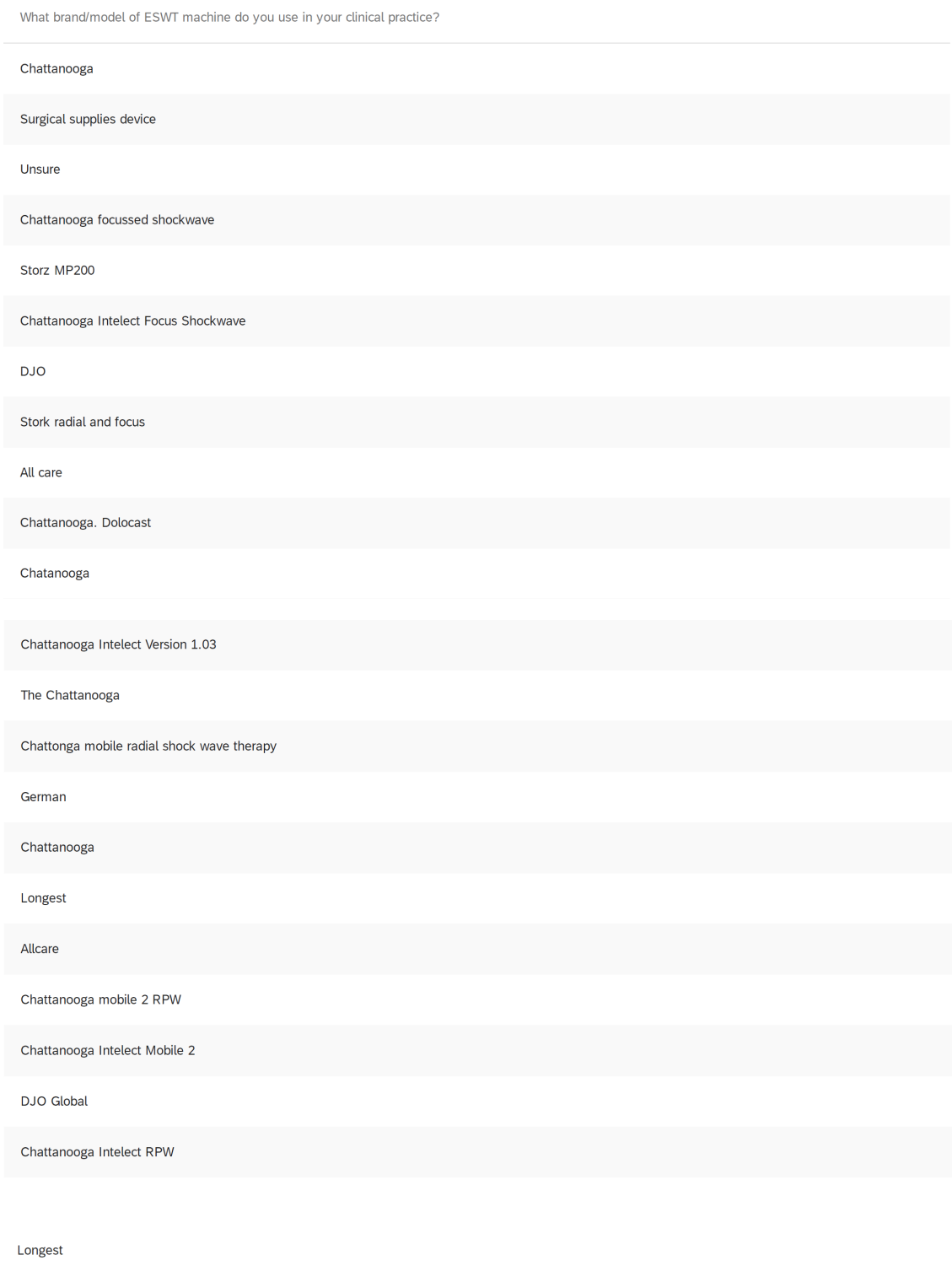


Figure 5.14 Brand/model of ESWT machine used

Data relating to the type of ESWT used is shown in **Figure 5.15**. Most participants used radial-ESWT (52%, n=12) followed by focused-ESWT (22%, n=5). Four participants (17%) used both radial and focused-ESWT, with two participants (9%) unsure of the type of ESWT used.

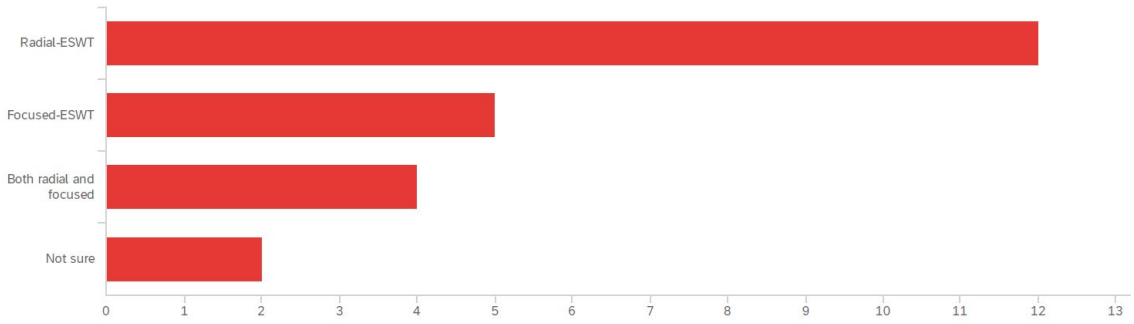


Figure 5.15 Type of ESWT used

Data relating to the date of purchase of the ESWT machine is shown in **Figure 5.16**. Most participants indicated that their machine was purchased within the last 1-5 years (52%, n=12). Thirty-nine percent of participants (n=9) purchased their machine more than five years ago, with 9% of participants (n=2) purchasing a machine within the last year.

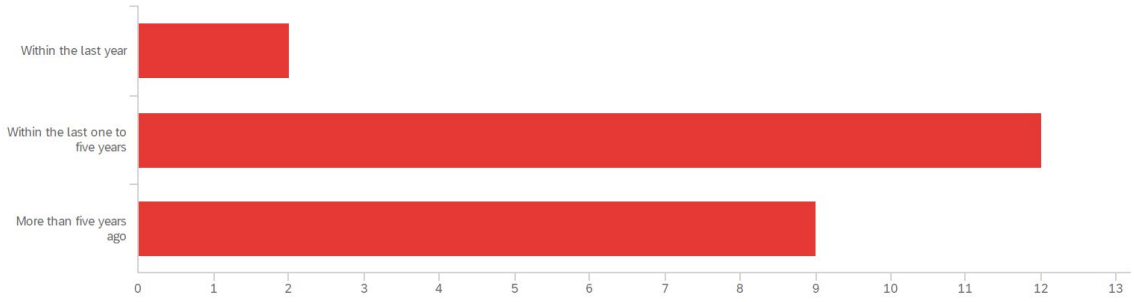


Figure 5.16 Date of purchase of ESWT machine

Data relating to training is shown in **Figure 5.17.** The most common method of training was peer-training (39%, n=18), followed by training with the manufacturer (28%, n=13) and online training (24%, n=4). Four participants cited other forms of training including seminars/workshops (n=2) and CPD courses (n=2).

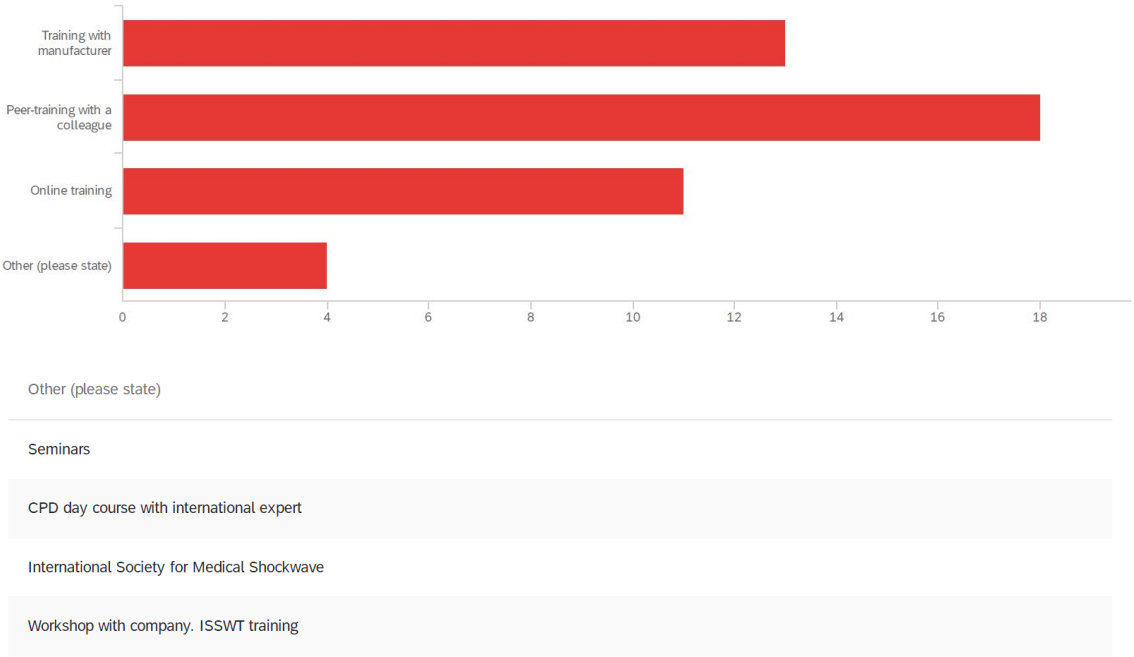
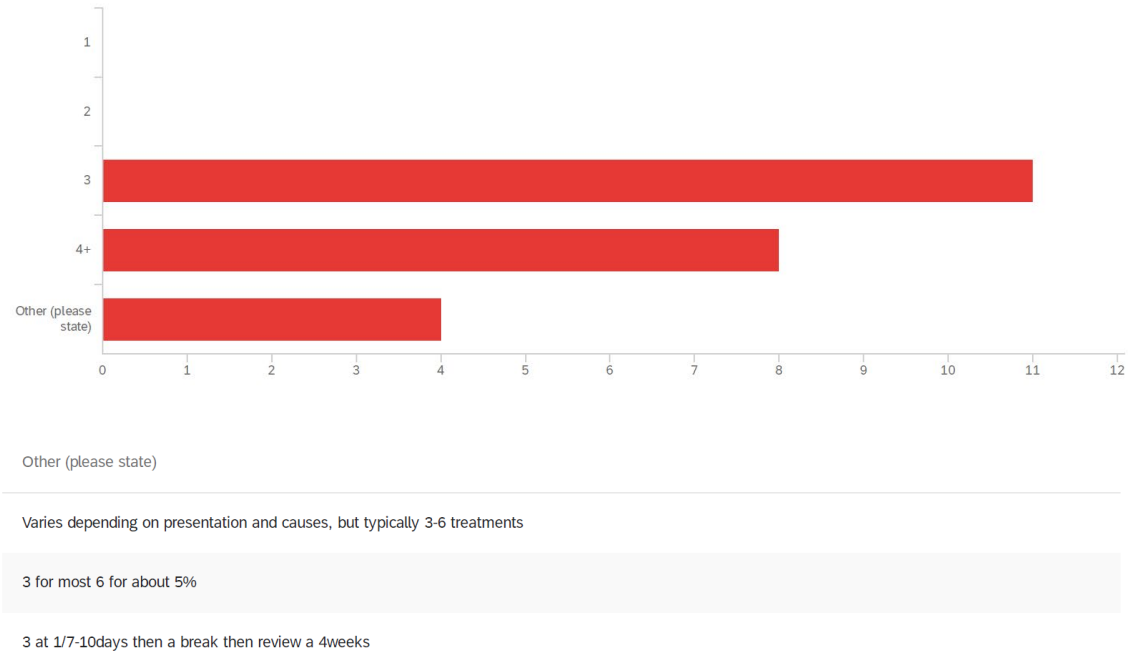


Figure 5.17 Training undertaken prior to using ESWT

Data relating to the number of treatment appointments used is shown in **Figure 5.18.** Forty-four percent of participants (n=11) indicated that they used three treatment appointments with 35% (n=8) using four or more treatment appointments when using ESWT. Four participants provided other responses including 3-6 appointments (n=2), 3-4 appointments (n=1) and 3 appointments (n=1). No participants indicated that they used one or two treatment appointments.



Other (please state)

Varies depending on presentation and causes, but typically 3-6 treatments

3 for most 6 for about 5%

3 at 1/7-10days then a break then review a 4weeks

Figure 5.18 Number of treatment appointments typically used for ESWT

Data relating to the time between treatment appointments is shown in **Figure 5.19**. Sixty-six percent of participants (n=16) indicated that treatment appointments were spaced 1 week apart, 22% (n=5) 1-2 weeks apart, with 9% (n=2) spacing treatment appointments 2-3 weeks apart.

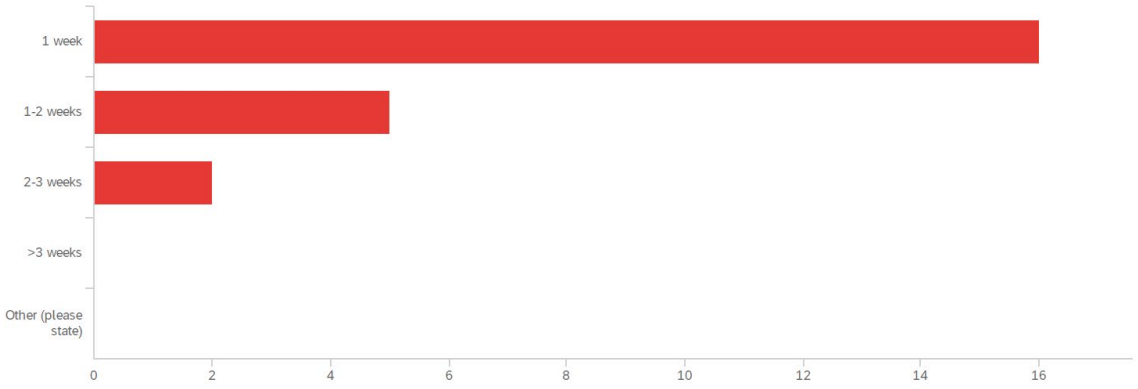
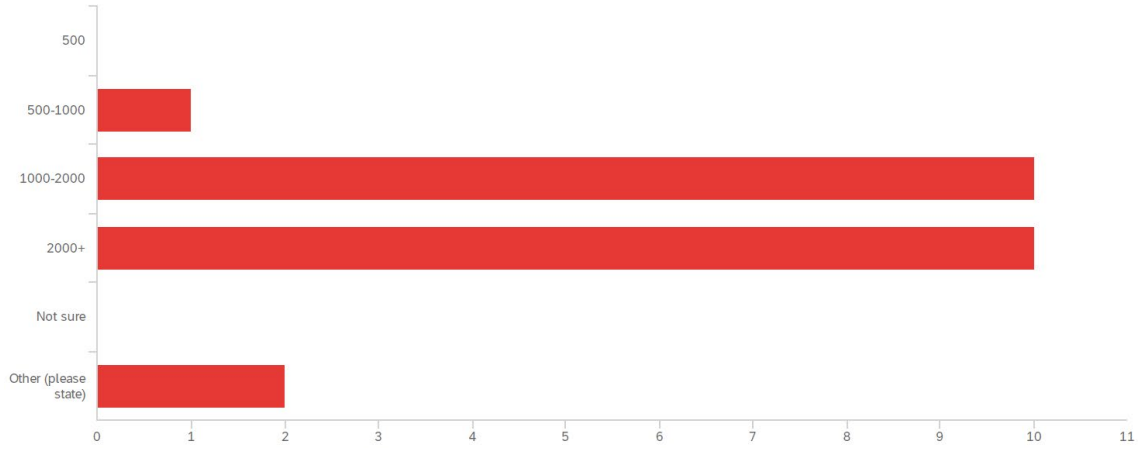


Figure 5.19 Time between treatment appointments

Data relating to the number of impulses (shocks) per treatment appointment is shown in **Figure 5.20**. The most common number of impulses per treatment appointment was 1000-2000 (44%, n=10) and more than 2000 (44%, n=10), with 5% (n=1) using 5000-1000 impulses. Two participants provided other responses, with the number of impulses ranging from 1000-3000 (n=1) and 4000-8000 (n=1).



Other (please state)

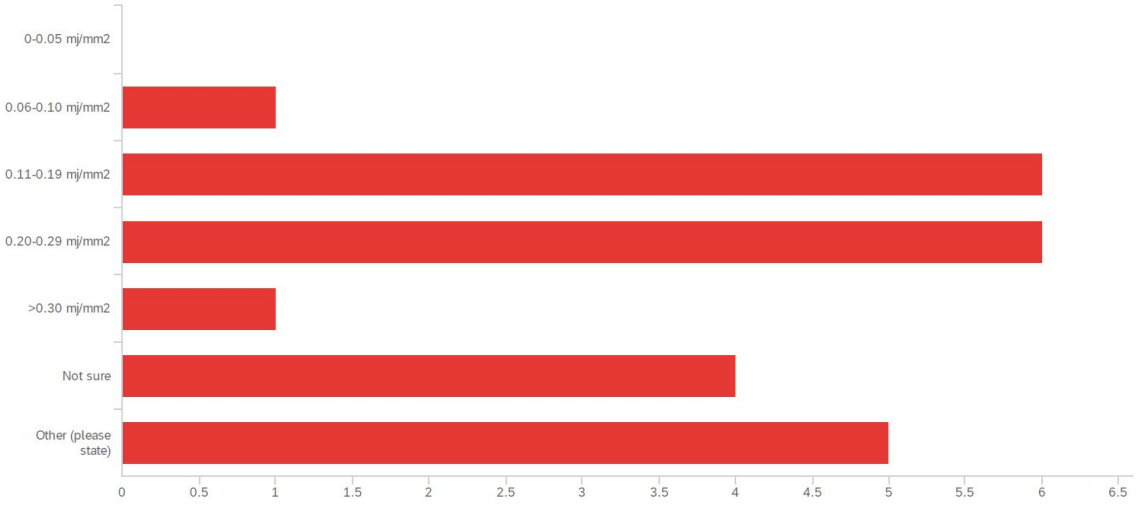
Heaps, usually 4000-8000 in one session but we use it all over the lower limb depending on what we found as a contributing factor in our assessment

Other (please state)

Typically 1000 radial over entire fascia, sometimes 2000 in trigger point of calf and or 1800 Focus

Figure 5.20 Number of impulses per treatment appointment

Data relating to the energy used per impulse is shown in **Figure 5.21**. The energy per impulse varied between participants with 4% (n=1) using 0.06-0.10 mj/mm^2, 26% (n=6) using 0.11-0.19 mj/mm^2, 26% (n=6) using 0.20-0.29 mj/mm^2, 4% (n=1) using more than 0.30 0.6-0.1 mj/mm^2, with 17% of participants 'not sure'. Five participants provided other responses including 0.07-2.0 mj/mm^2 (n=1), 0.8-1.8 bar (n=a), 0.3-4 bar (n=1), 4.2 bar (n=1), factory setting (n=1) and pain tolerance (n=1).



Other (please state)
Our measurement is in Bar, we would typically do 0.8-1.8 on the foot and 1.5-3.5 on the leg depending on the persons response
Radial 4.2 Barr pressure, focus I use factory setting
.07-2.0
Depends on pain tolerance
0.3-4 bar

Figure 5.21 Energy per impulse

Data relating to the frequency of impulses is shown in **Figure 5.22**. Sixty-one percent of participants (n=14) used 5-10Hz, with 26% (n=6) more than 10Hz, with 13% (n=3) at 1.5 Hz.

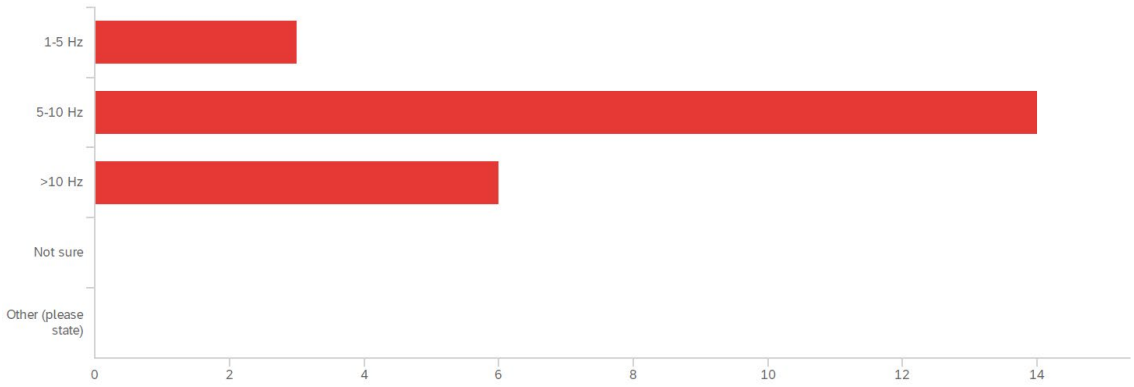
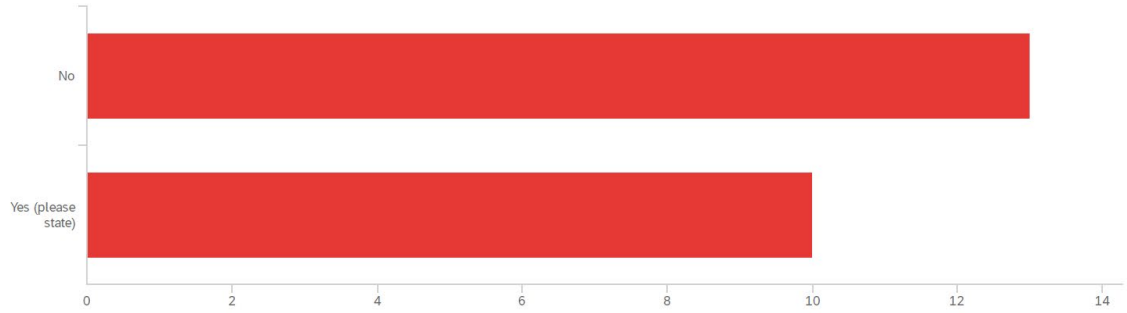


Figure 5.22 Frequency of impulse

Data relating to reported side-effects associated with ESWT is shown in **Figure 5.23.** Fifty-seven percent (n=13) reported no side-effects with 43% reporting side-effects. Of those reporting side-effects these ranged from an initial increase/flare in pain (n=8), dysesthesia/neurological symptoms (n=1), bruising (n=2) and nausea/headache (n=1).



Yes (please state)
Not often, but increased pain levels
I have found patients with insertion Al planter facial heel pain do not respond and have an increase in pain which can last for 7 to 10 days
Occasional initial flare of pain, pain releif for 24-36hrs
The odd person will get bruises, the odd person will get a bit of an acute ache after but usually settles quickly. Alot say it's painful - but a good pain. We try and work to a level of pain that is just tolerable to the patient.
The odd time there can be a flare up of symptoms but not often
Often immediate pain reduction, then within the next 48 hr increased pain
Improvement in pain reduction
Tingling residual sensation after session
Temporary increase in pain for a day or so after occasionally but then a big improvement
Bruising, nausea, headache, temporary pain increase

Figure 5.23 Side effects associated with ESWT

Data relating to additional comments describing participants' experiences of using ESWT are shown in **Figure 5.24**. Of the 23 open-ended responses, 14 included positive statements regarding the use of ESWT. Five participants stated the importance of using ESWT in conjunction with other interventions. Seven participants providing a 'no/not applicable' response.

No

n/a

No

I find it's best used in conjunction with other management strategies. Deep impact general muscular treatment also useful to treat anterior and posterior calf muscle groups alongside the plantar fascia, if standard stretching is not relieving muscle tightness.

generally useful additional variable for our treatments against PHP

Is there anything else you would like to share about your experience of usi...

I find it challenging for patients to understand that due to substance P inhibition any therefore short term pain relief and also reduction of symptoms in general gives the patient a sense of recovery and they tend to overdo/ not stick to our organised activity level. But I take this as a positive thing!

I always tell people that it is an another treatment modality and results are not gaurenteed or seen immediately

No

It is of huge benefit to nearly all PHP patients I have treated

Has changed my practice significantly, patients get better way faster, people love the shockwave and we get a lot of word of mouth referrals just for shockwave. We use the shockwave very liberally and always treat all over the lower limb. If they have PHP but also thickened achilles and trigger points in the gastroc and a tight ITBand we might treat all of those locations in one session, it would be a waste of time to just treat the plantar surface of the foot. We also on a regular basis do shockwave then use dry needling on a couple of areas that are resistant to soften with the shockwave to get a deeper muscle release. The combination makes for great results for patients. Research might suggest ~85% of people shockwave might help PHP, we find with the combination of treatments and liberal use of shockwave we easily get 95-99% of people improve, people with calcification at the fascia or in the achilles would be the most resistant to treatment with the radial pressure wave machine and often these people require moonboots and PRP injections as well as shockwave.

Very helpful in combo with supporting the foot, strengthening the foot and leg and allowing for the foot and ankle to be more flexible

No

I could not manage with out it, however it is not a stand alone treatment.

No

Best results come with education, load management, strengthening, orthotics, footwear alongside Swt

Correct diagnosis is, essential

Great resolution.

Usually after 4 sessions close together, better results seen

Definitely good treatment plan for php

Works really well for stubborn PHP

Often use it on the soleus as well if treating PF, more to help with tissue tightness/tension, seems to have a positive effect

it works well but you need to ensure you are giving enough energy otherwise it does not work

No

Figure 5.24 Additional comments

Chapter 6: Discussion

6.1 Introduction

This chapter will discuss the results of the survey, strengths and limitations of the study, implications for clinical practice and future directions.

6.2 Findings

6.2.1 Participant demographics

This is the first survey that investigated the use of ESWT for PHP by podiatrists in Aotearoa, New Zealand. The survey was completed by 30 participants, which represents 6% of the total number of registered podiatrists in Aotearoa, New Zealand. The response rate is similar to previous surveys of podiatrists in Aotearoa, New Zealand (Chapman et al., 2018). However, most participants were under the age of 40 years, held a Bachelor's qualification and worked in a private practice setting. The findings regarding qualification and age may be attributed to the Bachelor's-level qualification introduced in the 1990s and very few podiatrists who acquired the previous Diploma qualification still practising. Additionally, a high percentage of people in private practice is expected, as 80% of the podiatry workforce in Aotearoa, New Zealand, work in private practice (Carroll et al., 2020).

Almost all participants were treating more than one patient with PHP per week, indicating that PHP is a common foot problem seen in clinical practice in Aotearoa New Zealand. The population prevalence of PHP has been reported as being 10% in adults in the United Kingdom (Thomas et al., 2019). The most used interventions for PHP included education, strapping, stretching, footwear, foot orthoses, load management,

exercise prescription and ESWT. This aligns with best practice guidelines for PHP (Morrissey et al., 2021).

The majority of participants indicated that they use ESWT in their clinical practice or refer to other providers for ESWT. This high prevalence is likely due to the nature of the survey which may have attracted more podiatrists who have a specific interest in the use of ESWT in the management of PHP. For those not using ESWT, access and clinical ineffectiveness were reasons for this. The cost of ESWT machines may be a prohibitive factor for some clinicians. Additionally, other interventions such as stretching, strapping and foot orthoses have been shown to improve symptoms in people with PHP (Morrissey et al., 2021)

6.2.2 Clinical reasoning for the use of ESWT

For participants that used ESWT as part of their clinical practice, the majority indicated that their decision to use ESWT was guided by patients with persistent symptoms or those that did not respond to frontline treatments. This is consistent with best practice guidelines and clinical trial data (Morrissey et al., 2019). This is further supported by one-third of participants indicating that they consider using ESWT in patients with symptoms over 12-weeks in duration. A few participants indicated that the presence of acute symptoms guided the use of ESWT, which appears to conflict with published evidence. For example, Rompe et al. (2010) reported that ESWT was no more effective than stretching for people with symptoms less than six-weeks in duration.

When considering reasons not to use ESWT, the presence of acute symptoms was the most common justification, alongside success with other interventions. Several

participants cited pain tolerance as a factor in not using ESWT. Localised pain during and shortly after treatment are common side-effects seen with ESWT (Ogden, 2004; Roerdink et al., 2017). Pain catastrophising is also a feature in some presentations of PHP, suggesting that the patient's psychological health may also influence the clinician's decision-making.

6.2.3 Clinical protocols for the use of ESWT

The clinical protocols when using ESWT for PHP varied amongst participants. This may be due to several factors, including differences in machines, training, and clinical reasoning for using ESWT. In most responses, using radial-ESWT was most popular, followed by focused-ESWT, with the remaining small portion of participants being unsure. Evidence from previous trials suggests that both radial- and focused-ESWT are effective for PHP compared to other interventions or sham treatment (Hocaoglu et al., 2017; Speed et al., 2003; Rompe et al., 2003; Buchbinder et al., 2002). The location and area of pain will usually determine whether a radial- or focused-ESWT probe is applied (Şah et al., 2022).

With no safe practice guidelines for the number of impulses to use when applying ESWT for PHP, most participants used 1000-2000 or more than 2000 impulses. These findings are consistent with published trials using ESWT for PHP in which the impulses ranged from 2000 to 2500 and were beneficial in improving patient outcomes (Hocaoglu et al., 2017; Speed et al., 2003; Rompe et al., 2003; Buchbinder et al., 2002).

Optimal treatment protocols for ESWT have been reported to be three sessions at one-week intervals, with 2000 impulses per session (Schmitz et al., 2015). In the current

survey, most podiatrists in Aotearoa, New Zealand, reported using three or more sessions spaced one-week apart, which was believed to be the most effective timeline when using ESWT for PHP. The increase in treatment sessions may be due to the longstanding nature of chronic PHP presentations.

Most of the side effects reported by participants in the current survey are consistent with those outlined in previous literature (Roerdink et al., 2017). Skin irritation post-treatment, dysesthesia, swelling and pain one-week post-treatment were seen in less than 1% of patients treated by the Aotearoa New Zealand podiatrists. Complications associated with ESWT are unlikely to be present one-year following treatment, suggesting that ESWT is a safe treatment in Aotearoa, New Zealand.

6.3 Strengths and limitations

This study was the first to capture data on using ESWT by podiatrists in Aotearoa, New Zealand. This study was not without limitations. As IP addresses were not recorded, multiple responses from a single participant were possible. Survey responses were screened to ensure duplicate entries were not present. Most participants that completed the survey used or referred their patients for ESWT. The perspectives of those not using ESWT may provide further insight into the management of PHP. The sample size was smaller than hoped for (based on a total of 486 registered podiatrists in Aotearoa, New Zealand), which may limit the generalisability of the findings to all podiatrists in Aotearoa New Zealand.

6.4 Implications for clinical practice

Clinical education for using ESWT is limited, with most participants in this study receiving peer training or online training. Currently, no guidelines or protocols are available to podiatrists to support them in using ESWT. For novice users, this may be of concern depending on the presentation of a patient's injury and the contraindications to using ESWT.

Although the findings from this study have shown some commonality and consistency in the use of ESWT and its machine settings amongst podiatrists in Aotearoa, New Zealand, a one-day course on the use and indications for EWST would benefit podiatrists and allow them to use ESWT to achieve the most optimal patient outcomes in clinical practice.

6.5 Future directions

Future directions include comparing the efficacy of ESWT at the plantar heel to other sites of the lower limb and whether there is a link between tendon, fascia or muscle healing. This would improve understanding of whether adopting a range of ESWT sites could better promote the healing of chronic PHP and result in improved outcomes. Further studies could also explore implementing a multi-intervention approach to PHP, which includes ESWT alongside two or three simultaneous interventions that may work together to improve outcomes for patients with chronic PHP. Finally, future research could determine whether in-person training courses over online teaching would improve outcomes and understanding of PHP for lower limbs injuries among podiatric clinicians.

Chapter 7: Conclusion

ESWT has become increasingly popular in recent years, particularly in the management of chronic PHP. This dissertation reports the results of a study that investigated the prevalence of podiatrists using ESWT for the treatment of PHP in Aotearoa, New Zealand. The results of this study have identified the decision-making process adopted by podiatrists in Aotearoa, New Zealand when considering using ESWT for the treatment of PHP, as well as the clinical protocols and machine settings used. Overall, podiatrists' use of ESWT for PHP in Aotearoa, New Zealand, has demonstrated some consistency and was reported to be highly successful. However, further work is still required to determine the most appropriate training method to improve understanding of ESWT and promote its efficacy and safety when podiatrists use it in Aotearoa, New Zealand.

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Appendices

Appendix 1. Ethical approval

Auckland University of Technology Ethics Committee (AUTEC)

Auckland University of Technology
D-88, Private Bag 92006, Auckland 1142, NZ
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

16 September 2022

Michael Frecklington
Faculty of Health and Environmental Sciences

Dear Michael

Ethics Application: 22/264 **Extracorporeal shockwave therapy (ESWT) – a survey of podiatrists current practice in Aotearoa New Zealand**

We advise you that a subcommittee of the Auckland University of Technology Ethics Committee (AUTEC) has **approved** your ethics application.

This approval is for three years, expiring 15 September 2025.

Standard Conditions of Approval

1. The research is to be undertaken in accordance with the Auckland University of Technology Code of Conduct for Research and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard and that all the dates on the documents are updated.
8. AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted and you need to meet all ethical, legal, public health, and locality obligations or requirements for the jurisdictions in which the research is being undertaken.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact ethics@aut.ac.nz. The forms mentioned above are available online through http://www.aut.ac.nz/research/researchethics

(This is a computer-generated letter for which no signature is required)

The AUTEC Secretariat
Auckland University of Technology Ethics Committee

Cc: fnt6533@autuni.ac.nz; sarah.stewart@aut.ac.nz

Appendix 2. Advertisement

Research project

Podiatry New Zealand member, Keanu Laumatia-Paki is undertaking a research study as part of his Honours qualification at AUT. Keanu is looking for podiatrists that treat people with plantar heel pain to complete a survey about their use of extracorporeal shockwave therapy for the treatment of plantar heel pain (also known as plantar fasciitis). You can also choose to enter a draw to win a $100 Westfield voucher.

If you would like to find out more information about the study, please follow the link below.

This study has been approved by AUTEC [insert reference number].

More Information Here

*Once clicking the 'more information here' link participants will be able to see the participant information and survey

Appendix 3: Facebook advertisement

Kia ora koutou,

My name is Keanu Laumatia-Paki a podiatrist and Honours student at Auckland University of Technology. I am looking for podiatrists that treat people with plantar heel pain to complete a survey about their use of extracorporeal shockwave therapy for the treatment of plantar heel pain (also known as plantar fasciitis).

The survey is anonymous and takes around 15 minutes to complete. This study has been approved by the Auckland University of Technology Ethics Committee (AUTEC reference number 22/264).

If you would like to find out more information about the study, please follow the link below or copy it into your browser.

https://aut.au1.qualtrics.com/jfe/form/SV_5ndhNoIpORinmx8

Ngā mihi,

Keanu

AUT
TE WĀNANGA ARONUI
O TĀMAKI MAKAU RAU

Extracorporeal shockwave therapy (ESWT) – a survey of podiatrists current practice in Aotearoa

Survey Flow

Block: Default Question Block (2 Questions)
Standard: Demographic information (7 Questions)

Branch: New Branch
If
If Do you use extracorporeal shockwave therapy (ESWT) as part of your clinical practice for the mana... Yes, I use ESWT in my current practice Is Selected

Block: Clinical reasoning (4 Questions)
Block: Clinical protocols for the use of ESWT (11 Questions)

EndSurvey:

Branch: New Branch
If
If Do you use extracorporeal shockwave therapy (ESWT) as part of your clinical practice for the mana... Yes, I refer patients elsewhere for ESWT Is Selected

Block: Clinical reasoning (4 Questions)

EndSurvey:

Branch: New Branch
If
If Do you use extracorporeal shockwave therapy (ESWT) as part of your clinical practice for the mana... No Is Selected

Standard: Clinical reasoning for not using ESWT (1 Question)

Branch: New Branch
If
If You previously indicated that you do not use extracorporeal shockwave therapy (ESWT) as part of y... I do not believe the ESWT is an effective treatment for people with PHP Is Selected

Block: Block 5 (1 Question)

EndSurvey:

Page Break

Start of Block: Default Question Block

Q1 **Participant Information**

Project title
Extracorporeal shockwave therapy (ESWT) - a survey of podiatrists current practice in Aotearoa New Zealand

An invitation
Kia ora, my name is Keanu Laumatia-Paki and I am working with Dr Mike Frecklington and Dr Sarah Stewart to undertake a research project as part of a Bachelor of Health Science (Honours) qualification. I am inviting podiatrists to participate in an online survey study about the use of extracorporeal shockwave therapy (ESWT) for the management of people with plantar heel pain (PHP). This will involve you completing an online survey about your current practice habits relating to the use of ESWT for people with PHP. This information page will help you decide if you would like to take part in this study. Before you decide you may want to talk to other people about the study such as family/whānau, friends or colleagues.

What is the purpose of this research?
The purpose of this study is to better understand how many podiatrists in Aotearoa New Zealand are using ESWT as a treatment for PHP, as well as the decision-making process used by podiatrists when considering the use of ESWT as a treatment for PHP, and the clinical protocols and machine settings used by podiatrists when using ESWT for PHP. This study will also contribute my Honours qualification. The findings from this study may also be published in an academic journal and/or be presented at a conference.

How was I identified and why am I being invited to participate in this research?
As a registered podiatrist and member of Podiatry New Zealand, you will have been notified of the study through an email newsletter sent by Podiatry NZ. You are reading this participant information because you have followed the URL link in that email, to do so.

How do I agree to participate in this research?
Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. At the bottom of this page you will be asked to agree to participate or not participate. You are able to withdraw from the study at any time. Once you have submitted the survey, removal of your data will not be possible as the survey is anonymous.

What will happen in this research?
If you choose to participate, you will be directed to the first page of the survey. The survey takes approximately 15-20 minutes to complete. At the completion of the survey, you will be asked to submit the survey. The survey along with your answers will be submitted to me. The survey and answers submitted are anonymous, meaning neither I or any members of the research team will

know who they have come from.

What are the discomforts and risks?
There are no anticipated discomforts or risks with completing this survey.

What are the benefits?
Findings from this survey will provide us with an understanding of how ESWT is used for the management of PHP by podiatrists in Aotearoa New Zealand. The time dedicated to completing this survey can also be used as continuing professional development (CPD) evidence. Your participation will also be assisting a student in gaining their BHSc (Hons) qualification.

How will my privacy be protected?
All data collected will be anonymous, so it will not be possible to link your answers back to you. All data collected will be stored securely for six years.

What are the costs of participating in this research?
Other than your time, there is no cost to participate in this research.

What opportunity do I have to consider this invitation?
The survey link will remain open for four weeks.

Will I receive feedback on the results of this research?
If you would like feedback regarding the results of this study, please check the link after July 2023 (https://academics.aut.ac.nz/mike.frecklington/publications)

What do I do if I have concerns about this research?
Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr Mike Frecklington, mike.frecklington@aut.ac.nz, (09) 921 9999 extension 7832. Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, ethics@aut.ac.nz , (+649) 921 9999 ext 6038.

Whom do I contact for further information about this research?
You are also able to contact the research team as follows:

Researcher Contact Details:
Keanu Laumatia-Paki
Email: fnt6533@autuni.ac.nz

Project Supervisor Contact Details:
Mike Frecklington
Email: mike.frecklington@aut.ac.nz

Approved by the Auckland University of Technology Ethics Committee on type the date final ethics approval was granted, AUTEC Reference number type the reference number - to be

inserted once ethical approval has been granted

Q3 By completing this survey you indicate your consent to participate in the survey

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If By completing this survey you indicate your consent to participate in the survey = No

End of Block: Default Question Block

Start of Block: Demographic information

Q1 How many years have you been a registered podiatrist for?

- ○ Less than 5 years (1)
- ○ 5-10 years (2)
- ○ 10-15 years (3)
- ○ More than 15 years (4)

Q2 Which age range do you fit into?

- ○ 20-29 years (1)
- ○ 30-39 years (2)
- ○ 40-49 years (3)
- ○ 50-59 years (4)
- ○ 60+ years (5)

Q3 What is the highest formal qualification relevant to podiatry that you hold?

- ○ Diploma in Podiatry (1)
- ○ Bachelor of Health Science in Podiatry (2)
- ○ Postgraduate Certificate or Diploma (3)
- ○ Masters degree (4)
- ○ Doctoral degree (5)

Q4 Which of the following statements best describes your work as a podiatrist?

- ○ Private practice (1)
- ○ Public (2)
- ○ Research (3)
- ○ Education (4)
- ○ Other (5)

Q5 Approximately how many people with plantar heel pain do you treat during an average working week?

- ○ 0 (1)
- ○ 1-2 (2)
- ○ 3-5 (3)
- ○ 6-10 (4)
- ○ 10+ (5)

Q7 You previously indicated that you treat people with PHP. What interventions form part of your management for people with PHP?

- [ ] Education (1)
- [ ] Strapping (2)
- [ ] Plantar fascia stretching (3)
- [ ] Calf stretching (4)
- [ ] Footwear (5)
- [ ] Foot orthoses (6)
- [ ] Load management (7)
- [ ] Exercise prescription (8)
- [ ] Dry needling (9)
- [ ] Injection therapy (10)
- [ ] ESWT (11)
- [ ] Other (please state) (12) _____

Q6 Do you use extracorporeal shockwave therapy (ESWT) as part of your clinical practice for the management of plantar heel pain?

- ○ Yes, I use ESWT in my current practice (1)
- ○ Yes, I refer patients elsewhere for ESWT (2)
- ○ No (3)

End of Block: Demographic information

Start of Block: Clinical reasoning

Q8 What guides your decision to use ESWT for people with PHP?

- ☐ People presenting with acute PHP symptoms (1)
- ☐ People presenting with PHP symptoms that do not respond to other treatments (2)
- ☐ People presenting with non-resolving, persistent PHP symptoms (3)
- ☐ Other (please state) (4) _____

Q9 How long after the onset of symptoms would you considering using ESWT as a treatment for people with PHP?

- ○ Within 4 weeks of PHP symptoms (1)
- ○ Between 4-8 weeks of PHP symptoms (2)
- ○ Between 8-12 weeks of PHP symptoms (3)
- ○ More than 12 weeks of PHP symptoms (4)
- ○ Other (please state) (5) _____

Q10 What percentage of people with PHP that you see, do you use ESWT for?

	0 10 20 30 40 50 60 70 80 90 100
% of people PHP that you use ESWT for ()	

Q11 What guides your decision not to use ESWT for people with PHP?

_____

End of Block: Clinical reasoning

Start of Block: Clinical protocols for the use of ESWT

Q12 What brand/model of ESWT machine do you use in your clinical practice?

_____

Q14 What type of ESWT do you use for people with PHP?

- ☐ Radial-ESWT (1)
- ☐ Focused-ESWT (2)
- ☐ Both radial and focused (3)
- ☐ Not sure (4)

Q13 How long ago did you purchase your ESWT machine? (review)

- ○ Within the last year (1)
- ○ Within the last one to five years (2)
- ○ More than five years ago (3)

Q15 What training did you undertake prior to using ESWT for people with PHP?

- ☐ Training with manufacturer (1)
- ☐ Peer-training with a colleague (2)
- ☐ Online training (3)
- ☐ Other (please state) (4) _____

Q16 How many appointments using ESWT do you typically use for people with PHP?

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4+ (4)
- ○ Other (please state) (5) _____

Q20 How many weeks apart do you typically space your appointments when using ESWT for people with PHP?

- ○ 1 week (1)
- ○ 1-2 weeks (2)
- ○ 2-3 weeks (3)
- ○ >3 weeks (4)
- ○ Other (please state) (5) _____

Q18 How many ESWT impulses/shocks do you typically use per appointment?

- ○ 500 (1)
- ○ 500-1000 (2)
- ○ 1000-2000 (3)
- ○ 2000+ (4)
- ○ Not sure (5)
- ○ Other (please state) (6) _____

Q17 What ESWT energy flux density setting do you typically use per impulse/shock?

- 0-0.05 mj/mm2 (1)
- 0.06-0.10 mj/mm2 (2)
- 0.11-0.19 mj/mm2 (3)
- 0.20-0.29 mj/mm2 (4)
- >0.30 mj/mm2 (5)
- Not sure (6)
- Other (please state) (7) _____

Q19 What ESWT frequency (Hz) do you typically use per appointment?

- 1-5 Hz (1)
- 5-10 Hz (2)
- >10 Hz (3)
- Not sure (4)
- Other (please state) (5)

Q21 Have your patients reported any side-effects associated with ESWT?

- No (1)
- Yes (please state) (2) _____

Q26 Is there anything else you would like to share about your experience of using ESWT for people with PHP?

_____

End of Block: Clinical protocols for the use of ESWT

Start of Block: Clinical reasoning for not using ESWT

Display This Question:

If Do you use extracorporeal shockwave therapy (ESWT) as part of your clinical practice for the mana... = No

Q7 You previously indicated that you do not use extracorporeal shockwave therapy (ESWT) as part of your clinical practice for people with plantar heel pain (PHP). Which of the following statements best explains your decision not to use ESWT? (select all that apply)

- ☐ I do not have access to ESWT (1)
- ☐ I do not believe the ESWT is an effective treatment for people with PHP (2)
- ☐ I prefer to use other interventions for people with PHP (3)
- ☐ Other (please state) (4) _____

End of Block: Clinical reasoning for not using ESWT

Start of Block: Block 5

Q26 You previously indicated that you do not believe that ESWT is an effective treatment for people with PHP. Please explain why.

_____

End of Block: Block 5

Appendix 5: Prize draw

Prize draw

Start of Block: Demographics

Instruction **Prize draw**

Question Would you like to enter the draw to win a $100 Westfield voucher?

- ○ Yes (1)
- ○ No (2)

Page Break

End of Block: Demographics

Start of Block: Block 1

Question Please provide your email address so if you are successful, we can contact you and arrange for the voucher can be sent to you

_____

End of Block: Block 1