The Assessment and Management of Sesamoiditis in Aotearoa New Zealand

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2023

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A thesis submitted to

Auckland University of Technology

in partial fulfilment of the requirements for the degree of Master of Health Practice

Abstract

Background

Sesamoiditis is a common inflammatory condition affecting the sesamoid bones at the plantar aspect of the first metatarsophalangeal joint. Sesamoiditis causes pain and major physical limitations for patients, particularly during the propulsive phase of gait (toe-off). Podiatrists play an important role in the assessment and management of patients with sesamoiditis. However, there are currently no recommended objective clinical tests that should be considered when assessing and diagnosing sesamoiditis and there are no podiatry-specific guidelines on the management of sesamoiditis. The aims of this study were (1) to explore the views of Aotearoa New Zealand podiatrists on their approaches to assessment and diagnosis of sesamoiditis; and (2) to explore the views of Aotearoa New Zealand podiatrists on their approaches to management of sesamoiditis.

Methods

This qualitative study involved focus group discussions with New Zealand registered podiatrists. Focus groups took place online via zoom and were guided by a detailed focus group interview schedule. Questions were designed to promote discussion around assessment approaches used in the diagnosis of sesamoiditis and the treatment tools used to manage patients with sesamoiditis. Focus groups were audio-recorded and transcribed verbatim. Reflexive thematic analysis was used to analyse the data.

Results

A total of 12 registered podiatrists participated in one of four focus groups. Four themes were constructed relating to the assessment and diagnosis of sesamoiditis: (1) obtaining a patient history; (2) recreating patient symptoms; (3) determining contributing biomechanical factors; and (4) ruling out differential diagnoses. Seven themes were constructed relating to the management of sesamoiditis: (1) consideration of patient factors; (2) patient education; (3) cushioning of the sesamoids to allow more comfortable weightbearing of the 1st MTPJ; (4) pressure redistribution

and offloading of the sesamoids; (5) immobilisation of the 1st MTPJ and sesamoids; (6) facilitating efficient sagittal plane motion during gait; (7) managing patients who don't respond to podiatry treatment.

Conclusion

Despite the absence of any clear recommendations and guidelines on the assessment and management of sesamoiditis, the findings from this study have highlighted that podiatrists in Aotearoa New Zealand demonstrate an advanced analytical approach based on thorough clinical reasoning when caring for patients with sesamoiditis. The results from this study provide an increased understanding of current assessment and management practices used by podiatrists which is an important step in the development of recommendations that help guide podiatric assessment and management of sesamoiditis.

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Attestation of Authorship

I 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.

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Signature	Date

Acknowledgements

I would first and foremost like to acknowledge Auckland University of Technology for providing me the resources and means to be able to complete my planned vision of this thesis project.

My primary supervisor, Sarah Stewart, for her contributions, expertise, and time to this project.

My mentor supervisor Matthew Carroll for his valuable insights and support through the course of my postgraduate studies and thesis.

To all the participants of this study, a huge thank you for contributing your insights and experience to the research topic at hand. Without your participation this thesis would have not been possible.

Lastly, I would like to acknowledge my family who have been ever so supportive of my thesis journey at many stages and my friends who have witnessed this idea being executed into a thesis project.

This thesis is a result of all this collective support and effort. Thank you.

Chapter 1 Introduction

1.1 Anatomy and function

The human foot plays a vital role in bipedal locomotion. The first metatarsophalangeal joint (1st MTPJ), also referred to as the big toe joint, plays an important role in the propulsion or toe-off phase of gait. The plantar intrinsic foot muscles (abductor hallucis and flexor digitorum brevis) actively contribute to the stabilisation of the 1st MTPJ to assist propulsion (Farris et al., 2019). On the plantar aspect of the 1st MTPJ there are two sesamoid bones (referred to as the tibial and fibular sesamoids), which are embedded in flexor hallucis brevis muscle, facilitate plantarflexion of the 1st MTPJ. This complex anatomical structure is an important part of the propulsive phase of gait (Chou, 2000; Lee et al., 2005; Lombard et al., 2020; Pribut, 2010; Schweitzer & Karasick, 1988; York et al., 2017). In the average male, during walking, the sesamoid complex transmits fifty percent of the body's weight (York et al., 2017; Zhang et al., 2020). Additionally, the sesamoid complex can transmit up to three hundred percent of load during the propulsion phase in an average male's running gait (York et al., 2017; Zhang et al., 2020). The sesamoids increase the mechanical advantage of the flexor hallucis brevis and abductor hallucis muscles that plantarflex the hallux and aid in balance and stability of the joint (Lee et al., 2005; Lombard et al., 2020; Pribut, 2010).

1.2 Definition and epidemiology of sesamoiditis

Sesamoiditis, consequently, is the medical term used to describe the inflammatory condition that affects the sesamoid bones (de Oliveira Beraldo et al., 2020). Across the literature, there is a lack of a consistent definition of sesamoiditis, however, it appears to include both acute and chronic inflammation of the sesamoid bones and/or the joint capsule surrounding the bones (Chou, 2000). Substantial ground reaction forces that act on the plantar aspect of the 1st MTPJ during activity are reported to contribute to inflammation of one or both sesamoid bones and the surrounding soft tissues (de Oliveira Beraldo et al., 2020; York et al., 2017).

The prevalence of sesamoiditis is not consistently reported in the literature and there is very limited data available on the prevalence and incidence of sesamoiditis. A

systematic review of the epidemiology of ankle and foot overuse injuries in sports was conducted by Sobhani et al. (2013) in which the incidence rate of sesamoiditis over a four-year period amongst triathletes was reported to be 4.2% (Migliorini, 2011). More recently, Lievers et al. (2020) reported the epidemiology of foot injuries among college athletes. In this study, sesamoiditis accounted for 2.2% of all foot injuries, and 18.3% of all 1st MTPJ injuries (Lievers et al., 2020).

1.3 Mechanism of injury

Activities involving repetitive stress, such as running, jumping, and forced dorsiflexion of the 1st MTPJ are mechanisms that can result in sesamoiditis (Lee et al., 2005; Schweitzer & Karasick, 1988; York et al., 2017). A dorsiflexed 1st MTPJ position allows for the joint capsule to stretch, subjecting the sesamoid region to greater impact and loads and an increased risk of injury. Other factors, including artificial turfs that have higher frictional properties, can also predispose individuals to injuries of the 1st MTPJ (Chiou et al., 2020). However, in general there is a significant lack of published data on the mechanisms of sesamoid injury.

1.4 Clinical presentation and assessment

Sesamoiditis usually results in substantial physical limitation for patients, especially for active populations (de Oliveira Beraldo et al., 2020). These include difficulty weight-bearing through the plantar aspect of the 1st MTPJ, particularly during the toe-off/propulsive phase of gait. Standing and pivoting movements also cause significant pain where due to the increased demand on 1st MTPJ function. Symptoms and clinical presentation of sesamoiditis have been researched in existing literature and there is a clear consensus upon the topic (Andrews et al., 2021; Chou, 2000; de Oliveira Beraldo et al., 2020; Lillich & Baxter, 1986; York et al., 2017). Symptoms include difficulty weight-bearing barefoot, and a sudden or insidious onset of localized or diffuse pain at the plantar aspect of the 1st MTPJ (Andrews et al., 2021; Schweitzer & Karasick, 1988). Although the clinical presentation of sesamoiditis has been described clearly in existing literature, there is a complete lack of guidance on the assessment of sesamoiditis.

1.5 Imaging of sesamoiditis

Conventional radiography, ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI) are frequently used to examine 1st MTPJ and sesamoid pathology (Andrews et al., 2021; Chou, 2000; de Oliveira Beraldo et al., 2020; Dietrich et al., 2015; Kiener et al., 2017; Lillich & Baxter, 1986; Lombard et al., 2020; Schweitzer & Karasick, 1988; York et al., 2017; Zhang et al., 2020). Imaging is a useful tool to investigate the cause of the patients' symptoms and confirm diagnosis.

Conventional radiography is the first line modality of imaging that is used to examine the sesamoid bones. A lateromedial oblique view provides excellent visualisation of the sesamoid complex by reducing superimposition of other osseous structures, however a lateral view is also useful to observe proximal migration of the sesamoids to rule out differential diagnoses, including plantar plate tears (Lombard et al., 2020). The presentation of acute sesamoiditis often has a normal radiographic appearance, however chronic sesamoiditis associated with long-term repetitive stress can present with sclerosis on radiographic imaging due to increased density of the cortical bone (Kiener et al., 2017). Ultrahigh-resolution CT is also useful in visualising both cortical and trabecular bone pathology, particularly in early stages when conventional radiography may not be as sensitive (Lombard et al., 2020; Srinivasan, 2016).

While conventional radiography and CT are useful in more chronic presentations of sesamoid pathology, MRI imaging is useful in acute stress-related cases as it provides visualisation of early bone marrow oedema (Kiener et al., 2017; Nwawka et al., 2013; Schein et al., 2015; Srinivasan, 2016). MRI can also differentiate soft tissue from osseous pathology and is a useful tool in the investigation of the sesamoid complex (Schweitzer & Karasick, 1988). On MRI, non-pathological sesamoid bones have smooth and well-defined contours and a homogenous fatty signal (Lombard et al., 2020). As well as bone marrow oedema, MRI can also identify sesamoid stress reactions in the acute stages after the onset of symptoms (Andrews et al., 2021). The optimal plane for MRI is coronal (perpendicular to the long axis of the metatarsal) and sagittal plane, which can demonstrate displaced fracture fragments or diastasis of bipartite sesamoids (Lombard et al., 2020; Schweitzer & Karasick, 1988). Axial plane images are prone to partial volume effects which can cause a loss of contrast and result in

insufficient image resolution (Lombard et al., 2020). T1-weighted images are able to evaluate the signal intensity of the sesamoid bone marrow, while T2-weighted images can detect fat suppression (Schweitzer & Karasick, 1988).

Ultrasonography is also a useful imaging tool for sesamoid pathologies, particularly those involving surrounding soft tissue inflammation due to its high spatial resolution (Lombard et al., 2020). Ultrasound imaging is widely available and the use of dynamic manoeuvres during imaging is beneficial to observe the function of the sesamoid complex in real time (Lombard et al., 2020). It is also used in guiding corticosteroid injections, which are commonly used in the management of sesamoiditis (Lombard et al., 2020). A linear array high-frequency transducer (11-17 MHz) in the hands of experienced radiologists can be an accurate tool to examine surrounding soft tissue (including the plantar plate and flexor hallucis longus tendon) as well as the position of the echogenic sesamoids relative to 1st metatarsal head (Bancroft & Anderson, 2010).

1.6 Management

Although current literature agrees that conservative management is indicated before surgical options are considered (de Oliveira Beraldo et al., 2020; Dean et al., 2020; Saxena et al., 2016; Schein et al., 2015), there is a lack of data on the effectiveness of these strategies for the management of sesamoiditis. Consequently, there is an absence of any specific guidelines on how and when various conservative treatments should be implemented for the management of sesamoiditis. The reported conservative management options include immobilization techniques via splints, shoes, moonboots, and special orthoses (Chou, 2000; de Oliveira Beraldo et al., 2020; Saxena et al., 2016; York et al., 2017), as well as the use of anti-inflammatory drugs, rest, activity modification to reduce weight-bearing load and impact to 1st MTPJ, and cortisone injections (de Oliveira Beraldo et al., 2020; York et al., 2017). Saxena et al. (2016) also supported the use of radial soundwave therapy in athletes with sesamoiditis when other conservative treatments fail. This therapy produces non-ultrasonic sound waves that penetrate through the tissue, allowing for targeted application of energy at the level of the sesamoid apparatus.

Surgical management, which is considered when conservative measures fail, is not without risk for sesamoiditis and is not strongly evidence-based or protocol driven

(Taylor et al., 2014). Although excision of sesamoids is beneficial in relieving pain, it also poses complications, including the development of hallux valgus, hallux varus, cock-up deformity, claw-toe deformity, and weakness of hallux propulsion and gait changes (Lee et al., 2005; Moraes et al., 2019; Schein et al., 2015). The return to sports after surgery is mixed across the literature with only Dean et al. (2020) reporting promising results, in which 80% of athletes returned to sports after an average of 6.42 months post-surgery. The authors reported that participants who received a meticulous surgical technique, a post-operative rehabilitation program and positive patient-reported outcomes, had successful post-operative results with reduced risk of complications (Dean et al., 2020).

Chapter 2 Research Aim

There are clear gaps in the literature regarding sesamoiditis. Despite sesamoiditis being a common forefoot pathology, there is an absence of recommended objective clinical tests that should be considered when assessing and diagnosing sesamoiditis and there are no podiatry-specific guidelines on the management of sesamoiditis, including splinting, footwear prescription, orthotic prescription, or when to refer for invasive treatments (steroid injections or surgery). An understanding of current assessment and management practices used by podiatrists is an important step in the development of recommendations that help guide podiatric assessment and management of sesamoiditis.

The aims of this study are:

1. To explore the views of Aotearoa New Zealand podiatrists on their approaches to assessment and diagnosis of sesamoiditis.
2. To explore the views of Aotearoa New Zealand podiatrists on their approaches to management of sesamoiditis.

Chapter 3 Methodology

3.1 The primary researcher

I am an experienced sports podiatrist with over seven years of clinical practice in Aotearoa New Zealand. My caseload is primarily comprised of biomechanics and musculoskeletal podiatry, with 80-90% dominance in this area. My interest clinically has been in forefoot injuries and post-surgical rehabilitation. I believe the propulsive phase of gait is a vital part of human locomotion, and forefoot mechanics in general are often overlooked. Hence, sesamoiditis injuries have become of interest to me as they commonly present in private practice, but there is limited published guidelines on assessment and management techniques. Despite any published guidelines, I have managed these with success clinically and was intrigued to explore the perceptions and experiences of assessing and managing sesamoiditis amongst my colleagues in the podiatry profession.

3.2 Research design

3.2.1 Research type

This study is a qualitative study. I decided to take this approach because as a podiatrist myself, I was very aware of the need to understand the context and justification behind each podiatrist's dialogue related to their assessment and management approaches for sesamoiditis. A qualitative methodology would provide for richer data than a simple descriptive content or frequency analysis of the various assessments or management techniques used. As healthcare is individually tailored for patients, I wished to explore practitioners' perceptions and experiences behind their approaches to assessment and management, which would have been limited by a quantitative approach. A qualitative approach would therefore be much more apt in generating the meaningful data required to answer the research questions.

3.2.2 Research philosophy

The research philosophy I identify with is interpretivism, where reality is observed subjectively. This philosophy believes that the nature of reality (ontology) is socially constructed and can allow for multiple realities to exist (Pizam & Mansfeld, 2009). The

goal of research is based on understanding the research topic, the focus of interest is specific, unique, and deviant (Pizam & Mansfeld, 2009). Knowledge that is generated provides meaning which is relative to time, context, culture, or value bound (Pizam & Mansfeld, 2009). The participant/researcher relationship is interactive, cooperative, and participative (Pizam & Mansfeld, 2009). The desired information is relative to how individuals think and do, what problems they are confronted with and how they deal with them (Pizam & Mansfeld, 2009). The interpretivist world view was used to identify how the data was gathered, analysed, and used. An inductive approach was used to collect and analyse data, meaning that the codes produced were solely reflective of the content of data to best represent meaning as communicated by the study participants (Braun & Clark, 2013).

3.2.3 Time horizon

A cross-sectional time horizon was adopted for this research study as the nature of the research aims meant data could be collected at one point in time. Collecting data over multiple points in time would not have been beneficial to answer the research aims.

3.3 Participants

3.3.1 Inclusion and exclusion criteria

Participants were New Zealand registered podiatrists. To be eligible to participate, practitioners had to: (1) have at least five years of clinical experience; (2) be a current New Zealand registered podiatrist; and (3) have a predominantly (~60%) biomechanical/musculoskeletal clinical caseload. Practitioners who did not meet these three inclusion criteria were excluded from the study. Any practitioner that is not registered with the New Zealand Podiatry Board cannot be referred to as a podiatrist in Aotearoa New Zealand. Practitioners with five years of clinical experience are considered Senior Podiatrists who have attained thorough knowledge in their respective caseloads. Including only podiatrists who have predominantly biomechanical/musculoskeletal/sports podiatry caseloads ensures they are able to provide experience-based opinions on the assessment and management of sesamoiditis. These criteria were chosen to ensure a high-quality dialogue that specifically addressed the pre-defined research aims.

3.3.2 Sampling strategy

The sampling strategy that was used to select participants was probability sampling where both a random and representative selection of participants was present. Recruitment of participants was achieved through two strategies. Firstly, two advertisements, one month apart, were placed in monthly email membership newsletters from the only union/association of New Zealand podiatrists, Podiatry New Zealand. Podiatry New Zealand has 381 registered members, which equates to approximately 83% of the 457 registered podiatrists in New Zealand. Viewers of the newsletter who were interested and met the eligibility criteria were able to download a copy of the Participant Information Sheet and Consent Form containing the primary researchers contact details (**Appendix A**). Secondly, an invitation email was also sent to New Zealand's Accredited Sports Podiatry group to provide more targeted recruitment of sports podiatrists who may not be members of Podiatry New Zealand and would also have been more likely to be eligible to participate.

3.3.3 Sample Size

A pre-determined sample size of 12 podiatrists was guided by a high level of information power, achieved through the two highly specific pre-defined research aims, the inclusion of only experienced sports podiatrists as participants, the expected high quality of the dialogue, the use of a well thought out focus group schedule to guide discussion, and the planned in-depth thematic analysis approach (Malterud et al., 2016). This sample size allowed for a series of three focus group sessions with four participants in each. This sample size is also consistent with previous qualitative studies involving focus groups with podiatrists on assessment and management of other lower limb pathologies (Carter et al., 2019; Frescos & Copnell, 2020).

3.4 Data Collection

Data collection was completed online via zoom between July and August 2022. A detailed focus group question schedule was used by the researcher which guided the discussion on assessments and management approaches used for patients with sesamoiditis (**Appendix B**). The schedule was developed by the primary researcher, an experienced podiatric clinician, along with the supervisors who have experience in focus group research. Questions posed to participants were designed to promote

discussion around assessment approaches used in the diagnosis of sesamoiditis, and the treatment tools used in the management of patients with sesamoiditis. The researcher used prompts and follow-up questions to stimulate discussion among participants. The focus group discussions began with each participant introducing themselves before the opening questions were asked by the primary researcher. The schedule was then divided into part A which focused on questions related to assessment of sesamoiditis and part B which focused on management of sesamoiditis. The interview schedule was adjusted as the data collection period progressed and new questions were added to gain a deeper understanding of specific perceptions. All focus groups were audio recorded. The recorded data was transcribed verbatim by an external transcription service (Purple Giraffe).

3.5 Data Analysis

Data analysis was undertaken simultaneously with data collection using reflexive thematic analysis (Braun & Clarke, 2012). A six-stage approached to reflexive thematic analysis was undertaken (Braun & Clarke, 2006) which involves familiarisation with the data, generating initial codes, generating themes and subthemes, reviewing themes and subthemes, defining and naming themes and subthemes, and producing the report (Terry & Hayfield, 2021).

3.5.1 Stage 1: Familiarisation with the data.

The primary researcher used the time it took for external transcriptions to be completed (two weeks) to re-listen to the audio files of each focus group. Each focus group audio recording was revisited by the primary researcher in its entirety at least twice as the initial familiarisation process. A second stage of familiarisation followed which involved reading the transcript data files in their entirety at least three times. During this time, the primary researcher reviewed and updated any transcriptions that the external transcriber had noted as ‘indistinct’ and had been unable to transcribe. The familiarisation phase concluded when the primary researcher felt they were fully acquainted with the data. Familiarisation notes and initial observations were also made in a reflexive research journal during this phase (Terry & Hayfield, 2021).

3.5.2 Stage 2: Generating initial codes.

The transcripts were uploaded into NVivo software for analysis which was used to develop initial latent and sematic codes. The researcher referred to the research questions consistently throughout the initial coding stage to ensure codes were directly reflective of the research questions. Any quotes within the transcripts that may have been useful in addressing the research questions were coded. Each code represented a label for a distinct piece of information that was relevant to the research questions. The coding in NVivo was further organised in two sections to reflect the two main research questions (i.e., by assessment and management). Codes that were deemed relevant to both were coded under both categories. Multiple iterations of coding were done as the researchers went through the transcripts in their entirety more than once. Notes were also taken throughout the process about how the codes might later fit together as themes in the primary researcher's notebook and further on Miro board. Following the initial generation of codes there were 39 codes created under the assessment section and 12 under the management section. The initial codes were reviewed by the primary supervisor during regular discussions via Zoom which took place between the primary researcher and primary supervisor after each coding session to further refine these codes.

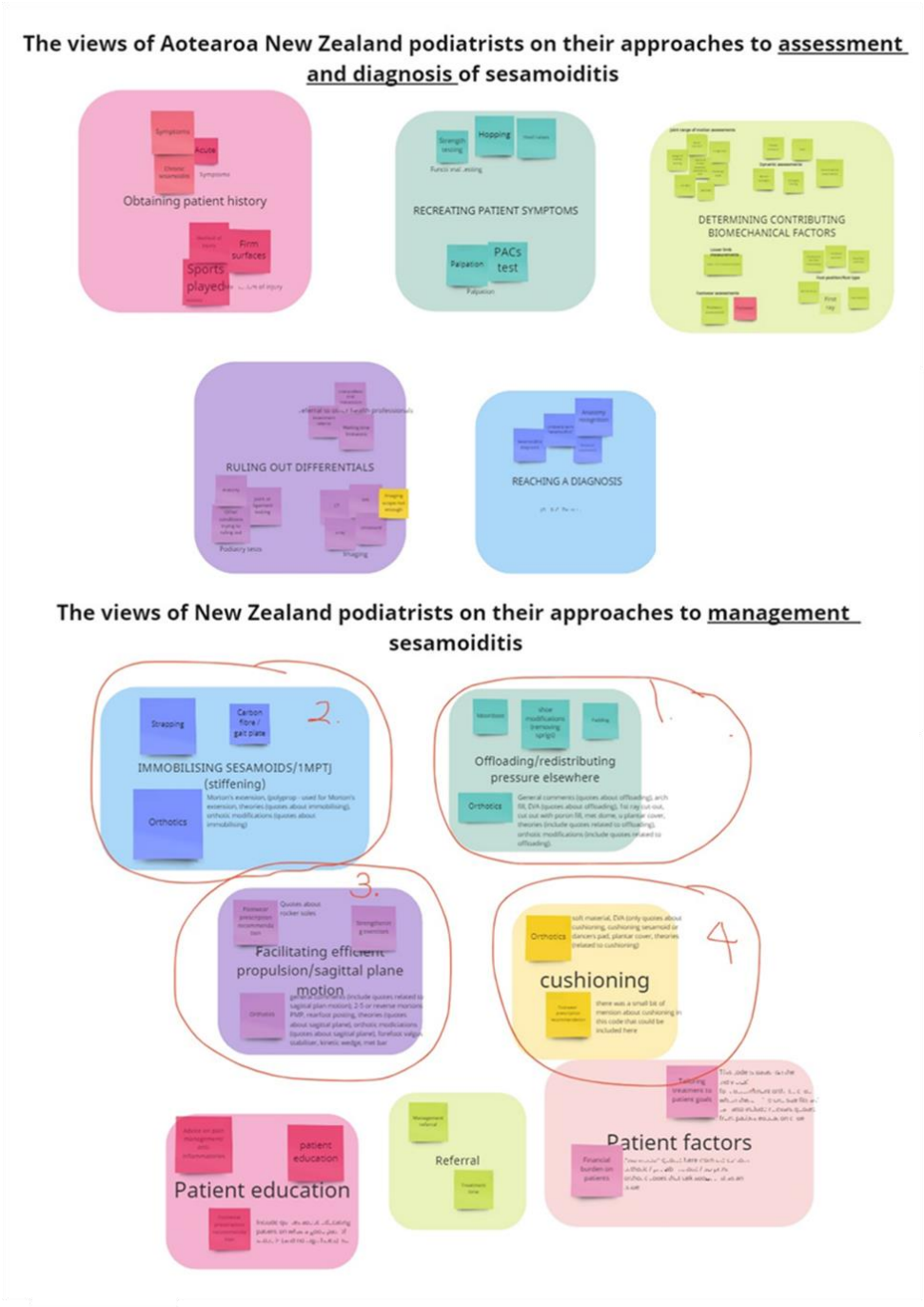
3.5.3 Stage 3: Generating themes and subthemes.

After all transcripts had been coded, the generation of prototype themes began. An online tool, Miro board (**Figure 1**), was used by the primary researcher and primary supervisor to collaborate and generate themes and sub-themes which arose from the latent and sematic codes. This process involved both individual inputs by the primary researcher and supervisor and collaborative input via Zoom meetings. Theme development was a process that evolved throughout the analytical process through to write-up of the results. Themes and subthemes were constructed using multiple techniques (Terry & Hayfield, 2021). Some codes were distinct and large enough to become a theme on their own, e.g., all data pieces/quotes coded as relating to 'palpation' became a theme in itself and included data codes discussing many different points of palpation, why this was important, in what context clinicians were using this test, their different palpation techniques and more. Some themes were generated by a combination of codes that all related to the same underlying concept e.g., the theme

relating to ‘referrals’ was made up of multiple codes, including “management referrals” and time “treatment time.”

Figure *1*

Online tool, Miro board, used to generate themes and subthemes



3.5.4 Stage 4: Developing and reviewing themes and subthemes.

The purpose of this stage of reflexive thematic analysis was to confirm that each theme contained a strong central organising concept and that the themes were conceptually rich and distinct (Byrne, 2021). This stage involved adjusting the themes and subthemes to ensure that the coded data accurately reflected the central concept of that corresponding theme/subtheme. As above, Miro board, was used to collaboratively review themes between the primary researcher and supervisor. In practice, this involved codes being grouped together on Miro board to link codes together that supported a central discussion point/theme. This stage also involved removing themes that were already represented by other themes. This reflexive and collaborative approach was undertaken to achieve richer interpretations of the meaning of the codes (Byrne, 2021). Miro board also allowed both researchers to sense-check the ideas that were being mind-mapped which allowed for discussions and notes to be produced during multiple interpretations of the data (Byrne, 2021).

3.5.5 Stage 5: Defining and naming themes and subthemes.

Theme definitions were constructed during the write-up phase to summarise the main insights and patterns that had been realised within each theme. Each theme's central organising concept was extended into a paragraph-length definition of that theme. The definitions helped to refine the themes further and confirm that the themes had the depth and level of detail to tell a story (Terry & Hayfield, 2021). The suitability of the theme names was assessed by reviewing all codes and their respective data. The theme names were revised and finalised to reflect the relationship between the codes within that theme. This was achieved by collaborative Zoom discussions and shared editing of word documents between the primary researcher and supervisor.

3.5.6 Stage 6: Producing the report.

In this phase, the theme definitions were expanded by adding quotes and excerpts from the transcriptions. The quotes and excerpts were chosen to ensure that they illustrated the central organising concepts of the themes and subthemes. Additionally, two mind maps representing each research question were generated to graphically visualise how the themes and subthemes fit together to tell the overall story and answer the research questions.

3.6 Study rigor

Study rigor was ensured by addressing credibility, transferability, dependability and confirmability to establish trust and confidence based on recommendations of Guba and Lincoln (1982).

3.6.1 Credibility

To enhance credibility, an established research process - thematic analysis (Braun & Clarke, 2012) was employed to analyse the transcribed data with a reflexive approach. Published recommendations from experts in the field were continually sought and reviewed to support the design and approach of this research (Byrne, 2021; Terry & Hayfield, 2021). The primary researcher completed a faculty workshop on thematic analysis run by Dr Gareth Terry at Auckland University of Technology Akoranga campus which covered study design, interview techniques and analysis methods for qualitative descriptive research. Both the primary researcher and supervisor were able to peer examine and debrief after the focus group audio recordings and transcripts were available. Finally, participant quotes and excepts were used verbatim in the write up to ensure the experiences of participants were recognised and portrayed through the researchers' interpretations.

3.6.2 Transferability

The research methods contain a detailed description of the study methodology, including a description of the participant inclusion/exclusion criteria and sampling framework, the location of the data collection (online via Zoom), as well as a detailed outline of six stages of thematic analysis and how these were applied to the data. The primary research also spent time reflecting on the philosophical stance and approach to the research questions and design which were transparently described in the research methodology. Finally, a detailed description of the participant demographic and geographic characteristics were collected and reported alongside the primary findings.

3.6.3 Dependability

To enhance dependability (the degree to which the findings would be comparable if the study were repeated), the audio files, transcribed data and a reflexive journal were

maintained during the data collection and analysis process to provide an 'audit trail' (Guba & Lincoln, 1982; Lincoln, 1995). Online tools such as Miro board and NVivo were used to help manage and store date. These tools enabled us to communicate collaboratively on an editable platform where the risk of misplacing notes/documents were effectively minimised.

3.6.4 Confirmability

The focus group question schedule was developed to ensure confirmability (that the findings are the thoughts of the participants and not the researcher) (Guba & Lincoln, 1982; Lincoln, 1995). In addition, the researcher concluded each focus group with a summary of the discussion points and encouraged participants to share any final comments not already covered. Illustrative quotes from the discussions were selected to support and provide evidence for each theme and subtheme. A self-critical attitude was opted by the primary researcher, who acknowledged and considered any preconceptions related to the research questions that may have affected the interviews and the analysis and interpretation of the data. Potential preconceptions and biases were discussed regularly between the primary researcher and supervisor to ensure they were kept to a minimum at all stages of the research.

3.7 Ethical considerations

This study was approved by approved by the Auckland University of Technology Ethics Committee (AUTEC) on 12 April 2022, AUTEC Reference number 22/72 (**Appendix C**).

3.7.1 Primary ethical considerations

As the primary researcher shares the same social and cultural context as the participants, who are also qualified and experienced sports podiatrists, the potential for risk to participants in the study was low. The potential risk of participating in this research may be one of confidence amongst their peers. However, the primary researcher endeavoured to create a safe environment where dialogue was open-ended and non-judgemental. Everyone's input was valued and respected. Ground rules were formulated and included in the interview schedule that assisted the researcher to help create this environment in focus groups. Potential risk because of cultural, employment, financial or similar pressures was none to minimal in this project as the

focus group aims were focused on addressing clinical assessment and management techniques of each participant which is unique and justifiable to their own practice.

3.7.2 Treaty of Waitangi

The Treaty of Waitangi principles of partnership, participation, and protection were used to inform the design and conduct of the study.

Partnership

The qualitative research design involving focus groups allowed for a relationship of mutual respect between the primary researcher and participants. There were minimal risks of any conflict between the researcher and participants as both socially belonged to the same group of registered New Zealand podiatrists in which their scopes of practice, professionalism, and code of conduct were mutual. It was therefore in the best interest of both the researcher and the participants to uphold these values and act honourably and with good faith towards each other. Partnership was also implemented through open communication and transparency between the researcher and potential participants who were invited to contact the researcher should they have any questions or concerns regarding the study. All participants were provided with a participant information sheet and were encouraged to contact the primary researcher with any questions. All questions were answered clearly and transparently.

Participation

There participants were principally involved in sharing their knowledge, experiences, and thoughts in the study via participating in focus group discussions. All participants were offered koha in the form of a voucher to acknowledge their participation and partnership in the project. All participants were also offered a summary of the results of the research to acknowledge their participation in this project.

Protection

The researcher only be guided and prompted the discussion in the focus groups to encourage a rich and in-depth dialogue focused on the research questions. The minimal/absent power imbalance between the researchers and participants encouraged an open dialogue. Cultural and other diversity was welcomed and respected by the researcher and encouraged among all participants. Utmost care was taken not to identify individual participants in any dissemination arising from the study

and all transcribed data was de-identified to ensure privacy and confidentiality of the participants.

Chapter 4 Results

4.1 Participant characteristics

The characteristics of the sports podiatrists included in the current study are presented in **Table 1**. There was a total of 12 participants in this study that took part in one of the four focus groups, including five (42%) females and seven (58%) males. The number of years in podiatric practice ranged from eight to 44 with most participants obtaining their initial training in Aotearoa New Zealand. Two thirds went on to obtain postgraduate qualifications. Most of the participants were from the North Island, and all practiced in the private health sector.

Table *1*

Participant Characteristics

PARTICIPANT ID	GENDER	FOCUS GROUP	YEARS IN PRACTICE	COUNTRY OF TRAINING	QUALIFICATION	COUNTRIES PRACTICED IN	CURRENT REGION OF PRACTICE	PRIVATE OR PUBLIC
P01	Female	#1	44	United Kingdom	Postgraduate	Australia, New Zealand, United Kingdom.	South Island	Private
P02	Female	#1	15	New Zealand	Postgraduate	Australia, New Zealand, United Kingdom.	North Island	Private
P03	Male	#1	13	New Zealand	Postgraduate	New Zealand	North Island	Private
P04	Male	#1	20	New Zealand	Undergraduate	New Zealand	North Island	Private
P05	Male	#2	14	New Zealand	Postgraduate	New Zealand	North Island	Private
P06	Male	#2	08	New Zealand	Postgraduate	New Zealand	North Island	Private
P07	Female	#2	14	New Zealand	Postgraduate	New Zealand	North Island	Private
P08	Female	#2	10	New Zealand	Postgraduate	New Zealand	North Island	Private
P09	Male	#3	35	New Zealand	Undergraduate	New Zealand	North Island	Private
P10	Female	#3	09	New Zealand	Postgraduate	Australia, New Zealand	North Island	Private

P11	Male	#3	25	New Zealand	Undergraduate	New Zealand	South Island	Private
P12	Male	#3	18	New Zealand	Postgraduate	Australia, New Zealand	South Island	Private

4.2 Definition of sesamoiditis

Although the diagnostic label 'sesamoiditis' literally translates into inflammation (-itis) of the sesamoids, the appropriateness of this label was debated amongst practitioners in the current study:

> *"I would call sesamoiditis slightly a garbage term" (P09).*

Many practitioners perceived sesamoiditis as an umbrella term encompassing diverse pathology of the 1st MTPJ:

> *"It's a bit like plantar heel pain or plantar fasciitis … sesamoiditis, if it gets referred to you, is very similar to that, … it's a big lumped in injury for an MTP joint sprain." (P11).*

However, there was consensus that sesamoiditis included inflammation of both the sesamoid bones themselves but also the surrounding soft tissue structures:

> *"… it's inflammation of the structures surrounding the sesamoids as well and you can argue, especially if your bifid or even trifid sesamoids in some cases, it's your cartilage that's actually surrounding it can become inflamed … it can also be associated structures in the hood surrounding the sesamoids as well" (P05).*

4.3 Prevalence of sesamoiditis in clinical practice

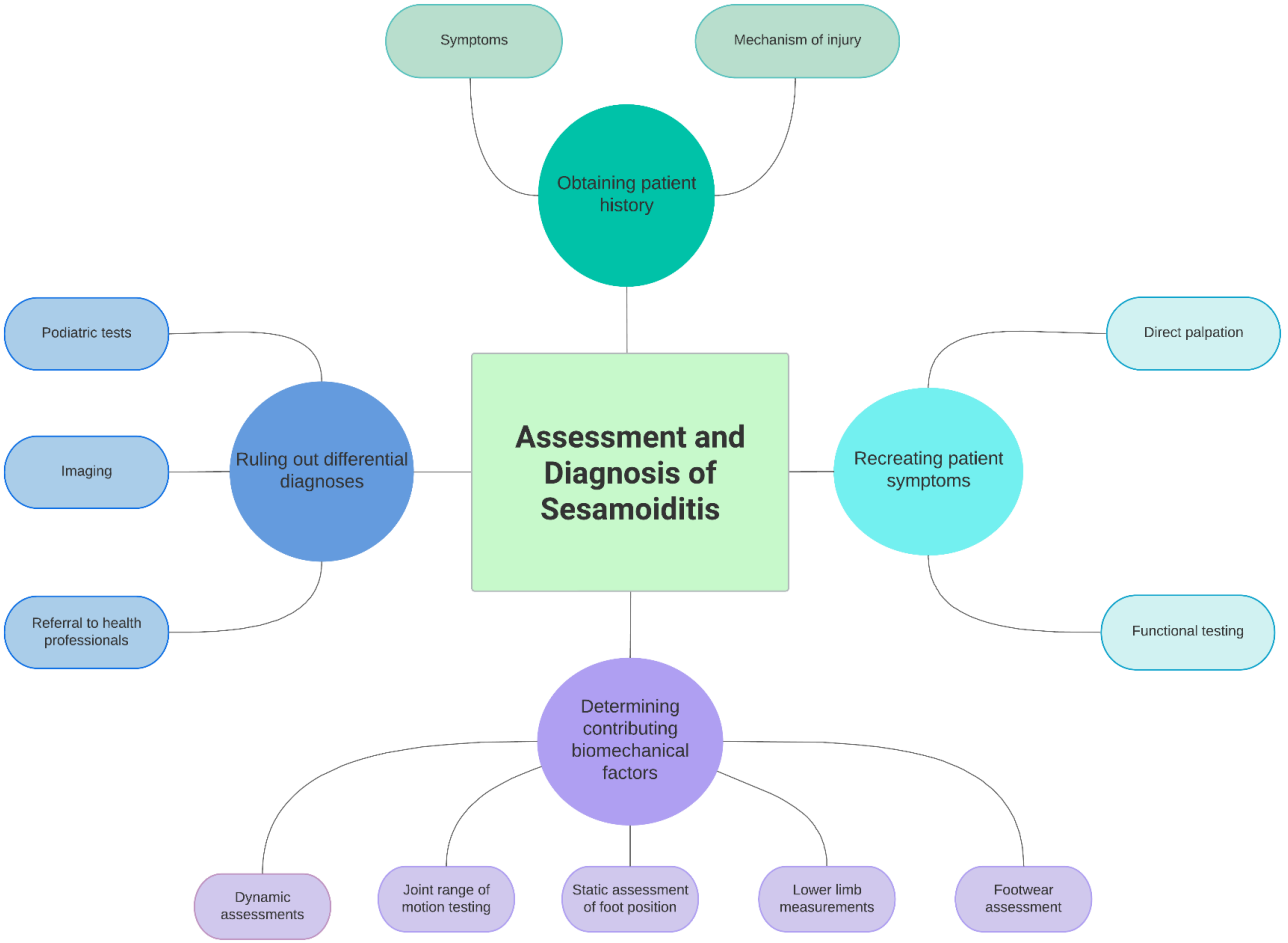
Practitioners in the current study encountered patients with 1st MTPJ pain frequently, however the number diagnosed with sesamoiditis was much lower. The prevalence of sesamoiditis varied considerably with some practitioners seeing it on a daily basis (two to three cases per day) or weekly basis (one to four cases per week), while others encountered it less frequently (one to three cases per annum).

4.4 Aim 1: Assessment and diagnosis of sesamoiditis

Four major themes were constructed relating to assessment and diagnosis of sesamoiditis. These were (1) obtaining a patient history; (2) recreating patient symptoms; (3) determining contributing biomechanical factors; and (4) ruling out differential diagnoses (**Figure *2***).

Figure 2

Mind map showing themes and subthemes related to the assessment and diagnosis of sesamoiditis.



4.4.1 Theme 1: Obtaining a patient history

Obtaining a thorough patient history was an important facet to podiatrists' assessment and diagnosis of sesamoiditis. This theme included two subthemes which encompassed symptoms and mechanism of injury.

Symptoms

Obtaining information about patient-reported symptoms was described by most practitioners as an important aspect of subjective questioning. Determining the location where the patient reported symptoms was important in establishing which structures were involved:

> *"I probably try to get a lot of information from my subjective assessment which is then gonna guide to the approximate region that the person is talking about, try to work out what kind of tissues are involved" (P03). Observation of the area for any swelling was also of interest "Is there swelling around the area?" (P05).*

Podiatrists were also interested in determining whether the symptoms represented an acute or chronic pathology:

> *"A history is like super important to gage. How long has this being going on for? And how did it happen? … Did it happen gradually? Was it all of a sudden?" (P10).*

The majority of practitioners agreed that most patients reported a duration of symptoms in line with more chronic presentations of sesamoiditis and often scheduled a podiatry appointment well after the initial injury had occurred:

> *"Most of them have been with a physio or a GP or someone, [or are] trying to manage it themselves … for a period of time" (P11).*

Mechanism of injury

Determining the mechanism of injury was highlighted by podiatrists as important when assessing and diagnosing sesamoiditis. In addition to questioning the patient about potential events that may have resulted in the injury some podiatrists also asked patients to re-enact the movement:

> *"I'm listening to what's the mechanism of injury usually, if they can recall it, which is hard 'cos no one's gonna twist their foot and then*

> *quickly take notes. I get them to, if they can, replay or show me the mechanism" (P05).*

Movements or injuries involving hyperextension of the 1st MTPJ, toeing-off with the 1st MTPJ in a flexed position, and rotational 1st MTPJ movements were perceived as commonly being associated with injury to the sesamoids. Mechanisms involving increased or high loads and power, which place the sesamoids under high stress, were also considered useful in establishing a diagnosis. Many podiatrists also noted a link between sesamoid injuries and sports involving firm surfaces, high propulsion, rotational movements, and/or repetitive movement and impact:

> *"Early season rugby [or] football training where the ground is still hard, there seems to be a little bit of an influx where you might get quite a few people in with pain in that sesamoid area and then at other times of the year as the grounds get softer … you don't seem to get them as often" (P02).*

Other sports that podiatrists questioned patients about due to their perceived link with sesamoid injuries included road running, dancing, netball, tennis, basketball, yoga, Pilates, sprinting, rock climbing, snowboarding, and pulling/pushing heavy objects.

4.4.2 Theme 2: Recreating patient symptoms

Recreating patient symptoms was a common topic that arose in discussions by podiatrists in this study. This theme included two subthemes that reflected different techniques used to elicit symptoms and aid in assessment and diagnosis of sesamoiditis: direct palpation and function testing.

Direct palpation

Direct palpation of the tibial and fibular sesamoids was the most common method used to elicit symptoms and was reported by all podiatrists in the current study. Palpation was used early on in the appointment to confirm the location of pain at the sesamoids and non-involvement of the rest of the 1st MTP joint:

> *"I normally just push on the sesamoid bone and go, oh, yeah" (P06).*

In addition to direct pressure to the region with the foot in a relaxed position, some podiatrists also described performing a passive axial compression (PAC) test which allowed them to:

> "… get in there and give it a good wobble" (P08).

This test involved placing the hallux in a maximal dorsiflexed position (causing distal migration of the sesamoids), before applying proximal compression to the sesamoids to stabilise them. The hallux is then plantarflexed and if symptoms are produced this indicates a positive test.

Functional testing

Dynamic tests such as muscle testing, hopping tests and heel raises were commonly used by podiatrists to help elicit symptoms. Hopping and heel raises were used to test the sesamoid pully function by simulating the propulsive phase of gait where the forefoot and sesamoids are subject to repetitive high loading:

> *"I like the calf raises, seeing how much they can tolerate, whether they can only do double leg or whether they can do single leg." (P06).*

Non-weight bearing testing involving resisted flexion and extension of the hallux was also used to recreate symptoms:

> *"I'd also look at some functional strength so the flexors, extensors, just to see whether you can elicit any of the symptoms there." (P11).*

4.4.3 Theme 3: Determining contributing biomechanical factors

After establishing the diagnosis of sesamoiditis, additional assessments aimed at determining contributing biomechanical factors made up a large part of the initial appointment. The goal of these assessments was likened to piecing together a puzzle that created a clinical picture in line with the patients' unique presentations. However, there was no strict methodological set of assessments that were performed; rather, podiatrists were guided by the patients' unique individual presentations. Although podiatrists approached these assessments with an open mind, they still acknowledged patterns and trends in the contributing biomechanical factors:

> *"…It's probably made up of the bigger picture or the bigger findings that you're seeing but there are probably certain similarities or*

> *common trends that do occasionally seem to follow these injuries or tend to be the precursor to these kinds of injuries" (P02).*

This theme included the following subthemes: dynamic assessments, joint range of motion testing, static assessment of foot position, lower limb measurements and footwear assessments.

Dynamic assessments

In attempt to understand the general walking or running mechanics of the patient, many practitioners undertook gait analyses to assess the overall dynamics of the patients' lower limb and movement patterns that may have contributed to increased loading through the forefoot:

> *"… depending on what activity they do, say, they're doing sport or something, I probably go and get them having a bit of a run, just to see what aggravated it" (P07).*

Practitioners who had plantar pressure systems in their practices also found these beneficial in assessing dynamic loading of the sesamoid area:

> *"Weight distribution point of view, with a in shoe pressure or pressure plate is actually a good assessment tool in terms of understanding loading patterns through that joint." (P12).*

Some practitioners combined gait assessments with dynamic muscle testing:

> *"… muscle strength and other stuff that might clarify why they run like that" (P03).*

Isolated testing of specific muscles, including flexor hallucis longus, was also reported as helpful:

> *"I've been using the hi-pro dynamometer you can put underneath your toe to check that toe flexor strength. It's been noticeably weaker on the symptomatic side." (P12).*

Joint range of motion testing

Assessing range of motion of the 1st MTPJ, particularly dorsiflexion, was of interest to most podiatrists, in order to gain a better understanding of the windlass mechanism and loading through the 1st MTPJ during propulsion. Reduced midtarsal and/or ankle

joint range of motion was also assessed (either non-weightbearing or via the lunge test) to better understand the patients' propulsion mechanics:

> *"I've gotta be considering ankle joint range of motion cos if there's an ankle equinus we're gonna put more load through the forefoot anyway so it's trying to then treat the equinus." (P08).*

Some practitioners also assessed the amount of translation of the sesamoids in the transverse plane to determine whether these subluxations may be contributing to the development of inflammation in the area:

> *"…depending on the tone and how it's sitting, sometimes, in my opinion, that lateral sesamoid tends to be slightly more deviated so I like to give it a bit of a push from lateral and medial to see if that exacerbates any pain either" (P10).*

Static assessment of foot position

Static assessments of forefoot and rearfoot position were undertaken by a number of practitioners. Observing the position of the first ray (specifically a plantarflexed first ray) was useful in determining factors contributing to overloading and apropulsive toe-off patterns through this joint. Many podiatrists also reported examining the position of the forefoot (MPJ formula) to determine which MTPJs were subject to the highest loads during propulsion:

> *"I like to look at the forefoot alignment quite often, if they're a bit plantarflexed relative to the other met heads" (P06).*

Some practitioners also considered the rearfoot position or alignment of the calcaneus during static weight-bearing to provide them with further information about the rearfoot to forefoot relationship. Determining the patients foot posture was reported by several practitioners as being useful in guiding later offloading strategies:

> *"if they have a particular foot type where the way that they walk is really overloading that particular area … working around that and thinking more of the long term and thinking more preventatively as well so it doesn't become a recurring issue for them" (P02).*

Lower limb measurements

Although the consensus among practitioners was to avoid doing assessments, they felt weren't relevant, they were split on whether their biomechanical assessments were

focused specifically on the forefoot or included the entire lower limb. Some podiatrists focused solely on the area of pain:

> *"I'm not gonna go look at hip range and motion and that sort of thing so I'll keep it relative to what I'm thinking but I'm always going in with a clear mind" (P05),*

while others considered assessment of the entire lower limb, including leg length discrepancies and hip positions in order to determine whether more proximal factors could be contributing to the presentation:

> *"I start at the pathology site of concern and then work my way in reverse trying to look for patterns that could explain why this is occurring" (P04).*

Footwear assessments

Most podiatrists described a very thorough approach to assessing patients' current footwear to gain an understanding of their role in the development of sesamoiditis. Their assessment included evaluating wear patterns on the outsole/external shoe and indentations or wear patterns around the 1st MTPJ area on the internal shoe sock liner:

> *"I quite like looking at the insole of the shoe too, pulling that out and having a look and see if there's any obvious wear pattern can sometimes be a give-away" (P04).*

This often gave clues to a history of sesamoid overloading that was much longer than the onset of symptoms. Several podiatrists also reported assessing sprig placement on rugby and football boots which may also be associated with overloading the area. Shoes with poor structure and a minimalistic sole style were often reported as causative factors due to lack of cushioning and increased plantar loading to the sesamoids via repetitive movements. In addition to wear of the shoe and age of the shoe, fit, including sizing and width was also of interest to podiatrists:

> *"That depends on the fit of the boot, too. Sometimes people buy a boot that's too small or too big and that really affects [how] that metatarsophalangeal joint extends and flexes" (P05).*

4.4.4 Theme 4: Ruling out differential diagnoses

Incorporated into the practitioners' approach to assessment, was ruling out differential diagnoses. This theme included three subthemes: podiatric tests, referral for imaging, and referral to health professionals.

Podiatric tests

Podiatric specific tests were undertaken by the podiatrists in order to rule out other pathology associated with the sesamoids (including fractures, bipartite sesamoids, or avascular necrosis of the sesamoids) as well as pathology of neighbouring structures, including ligaments, joint capsules, plantar plates, tendons, and muscles. These assessments were based on utilising their detailed knowledge of local anatomy:

> *"I think we forget sometimes that we actually probably know the foot anatomy better than anyone else" (P08).*

This unique knowledge allowed a thorough assessment of neighbouring structures:

> *"… trying to test that plantar plate, like you would grabbing the metatarsophalangeal joint and seeing if you can distract that plantar plate and doing both medial and collateral ligaments as well." (P11).*

Assessment of the distal insertions of the flexor hallucis longs and brevis tendons as well as the insertions of abductor hallucis and the plantar facia were also considered. Podiatrists also reported ruling out inflammatory conditions such as osteoarthritis, gout, sepsis, and rheumatoid arthritis based on careful clinical assessment.

Imaging

Based on clinical assessment and severity of patient symptoms, some podiatrists reported seeking imaging investigations, including plain radiography, ultrasound, MRI, and CT, to assist in ruling out differential diagnoses:

> *"I don't tend to use much; I think mostly it's a clinical thing. If I'm suspecting a fracture or bipartite sesamoid or something like that, potentially an x-ray" (P03).*

Plain radiography was most commonly used for ruling out fractures, while ultrasound was recognised for its capability to assess both early osseous pathology and soft tissue pathologies. CT and MRI were often also required, however, referral to these services

within the Aotearoa New Zealand funded health system pathways were challenging for podiatrists and their patients. It became apparent in the focus groups, that the imaging scope for podiatrists in Aotearoa New Zealand is limiting. Podiatrists are currently able to refer for all imaging privately, however, patient affordability is a huge barrier to private services. Under the Accident Compensation Corporation (ACC) scheme podiatrists can refer for plain radiography and ultrasound, but any further funded imaging requires a referral through a sports physician or orthopaedic surgeon, which places another step and time delay in the referral pathway:

> *"I would like to be able to at some stage, refer for MRI or CT, because I think we know enough to do it but … I think ultrasound more than anything is fantastic for what we're doing but sometimes it'd be great to see in greater detail what's happening in a specific joint" (P05).*

Referral to health professionals

Practitioners in the current study reported referring to other health professionals to conduct assessments that were beyond their scope of practice. Referrals to general practitioners were undertaken where blood tests were required to rule out underlying systemic causes of sesamoid inflammation. Referrals to sports physicians or orthopaedic specialists were also common when the podiatrist felt that imaging outside of plain radiography and ultrasound was required for further assessment. Practitioners working in multidisciplinary practices, found interdisciplinary communication and referral pathways very supportive:

> *"We have lots of hallway's conversations about patients and we're quite happy to drag someone in to have a quick look and see whether we should be escalating it as well" (P09).*

This contrasted to practitioners in solo clinics or in rural areas within Aotearoa:

> *"I'm sending patients in, and they're not being seen 'til three months and MRI is the same. You've got no chance. Maybe four to six weeks prior to that or even two weeks before an appointment with the orthopaedic specialist…" (P10).*

4.5 Aim 2: Management of sesamoiditis

Seven major themes were constructed relating to the management of sesamoiditis. These were: (1) consideration of patient factors; (2) patient education; (3) cushioning

of the sesamoids to allow more comfortable weightbearing of the 1st MTPJ; (4) pressure redistribution and offloading of the sesamoids; (5) immobilisation of the 1st MTPJ and sesamoids; (6) facilitating efficient sagittal plane motion during gait; (7) managing patients who don't respond to podiatry treatment **Figure *3***.

Figure *3*

Mind map showing themes and subthemes related to management of sesamoiditis.

4.5.1 Theme 1: Consideration of patient factors

Participants in this study spoke at length about how their approach to managing sesamoiditis needed to be tailored to both the patients' specific goals and their financial situation, sometimes which influenced their ability to provide effective treatment.

There is no "one size fits all"

The podiatrists in the focus groups agreed that there was no single effective approach to treating sesamoiditis and each management plan had to be tailored to the individual patient:

> *"Depends on the patient, I suppose. A little bit of experience, but every foot is different, everything's not gonna be the same that presents" (P05).*

This perspective was particularly apparent when discussing orthotics and footwear, which required a level of creativity to ensure that not only the patient's foot type, but also other individual factors, were addressed:

> *"Something obviously will work for someone and it doesn't work for someone else so, as you said, creativity is key here … is it gonna fit into the shoe? Is it really realistic workwise? How long are they gonna be weight bearing on it from day-to-day? Is it durable? All of these variables you have to take into consideration when you are creating a management plan" (P10).*

Recognising patients' financial situation

Several podiatrists spoke about the patients' financial situation which needed to be considered, particularly when prescribing orthotics or recommending footwear, both of which can be expensive investments for patients. Some podiatrists adopted a step-by-step approach:

> *"I'll start really simple, like … just modifying the insole/sock liner if it's on the lower budget end. If we've got a little bit more money to work with then we'll do a prefab or a custom orthotic" (P06).*

The cost-barrier was particularly evident for podiatrists working in lower socioeconomic rural areas where many podiatrists also struggled with access to suitable and appropriate footwear options:

> *"… up here, we are a bit limited with footwear. We've got one sports shoe shop and the rest are quite …high end stuff. A lot of people I've noticed are starting to buy online which has been quite challenging. Obviously, I don't like to encourage it, but we're limited" (P10).*

4.5.2 Theme 2: Patient education

Patient education was discussed as an important component that was interweaved throughout several stages of the management approach. The goal was to improve patient understanding through tailored advice, that also included advice on pain management and adjusting patient expectations if they were less realistic.

Improving patient understanding

Several podiatrists discussed the importance of improving patient understanding through clear education and communication:

> *"I think people kind of wonder why that part of the foot gets to be sore, to an extent. I feel like patients are fairly relieved when you come up with a fairly definitive diagnosis" (P07).*

For many podiatrists, education also encompassed training and load management principles involving activity reduction and modification until symptoms reduced. Practitioners ensured that time was set aside during their consultations to provide education, not only on the diagnosis, but also the approach to management:

> *"I'm gonna spend that time educating them about what I think it is and how I think we're gonna manage it and also what I think my goal posts are gonna be" (P09).*

Advice of pain management

Reduction of pain and inflammation was a central focus of patient education. RICE (rest, ice, compression, elevation) was recommended for acute stages of sesamoiditis, but most podiatrists discussed pharmacological management with their patients. As podiatrists in Aotearoa New Zealand are limited by an absence of prescription rights, this involved recommending over-the-counter medications, or referral to a pharmacist of GP to provide prescriptions:

> *"I would suggest anti-inflammatories but obviously that's dependent on if they tolerate them. Sometimes if it is quite severe, I have suggested Diclofenac for maximum two weeks but to follow the box*

> *instructions and obviously go to the pharmacy. I'm not a pharmacist so I don't wanna get in trouble, but I certainly do recommend a course, just to take the edge off" (P10).*

Expectations vs. reality

Some practitioners highlighted the importance of communication and education when patients' expectations may have been less realistic:

> *"I am really brutal about women's footwear, and I basically refuse to treat anything which is gonna make my treatment compromised so I do sit down with people and have a pretty hard talk about how we're gonna make it work" (P09).*

However, for others, the socioeconomic status of patients dictated how they approached these discussions:

> *"I feel like I really need to be firm with my patients but I'm just not there yet … I do have to work with what people have because they don't necessarily have money to spare. I just work with what they've got but it's finding that equilibrium for both of us to make it work" (P10).*

4.5.3 Theme 3: Cushioning of the sesamoids to allow more comfortable weightbearing of the 1st MTPJ

Cushioning of the sesamoids by the addition of soft material, either via footwear recommendations or orthotic prescription, was considered during initial stages to allow more comfortable weightbearing of the 1st MTPJ.

Cushioning of the sesamoids via footwear recommendations

Recommending trainer-type footwear with adequate cushioning was discussed amongst the focus group participants:

> *"I'd say rocker sole, really thick cushion shoes and then gel forefoot cushion shoes" (P06).*

Providing advice to patients about avoiding thinner soled shoes (i.e., racing flats) was also discussed, as well as being aware that cushioning does compress over time depending on the level of activity and footwear may need to be replaced more often. Avoidance of high-heeled shoes, which not only lack cushioning, but also increase forefoot load was also discussed:

> *"I think it kind of goes without saying … it's obviously avoiding high heel shoes. Probably a really important point to make in your management" (P08).*

Cushioning of the sesamoids via orthotic prescription

Cushioning via orthotic prescription was achieved via the addition of softer materials to the orthotic to further reduce load through the sesamoid area during weightbearing:

> *"I'll use a softer based orthotic. We usually use a cushion foot bionic and pretty much some kind of first MTP pad, often double layered and, again, well bevelled" (P09).*

The addition of a softer cushioning material was also combined with firmer orthotic modifications (that aimed to offload or immobilise) to enable more comfortable weightbearing through the 1st MTPJ:

> *"Then some type of cushion cover … maybe a plantar cover over the top of the plastic Morton's extension to reduce how hard it feels under there … You have to go quite soft" (P06).*

4.5.4 Theme 4: Pressure redistribution and offloading of the sesamoids

Offloading the sesamoids was a prevalent theme in the discussions that took place in the focus groups. There were two subthemes that gave rise to this, including using moonboots, and more localised offloading strategies including padding, orthotics, and shoe modifications.

Using moonboots

The use of a moonboot to offload the sesamoids was described in situations where severe or acute inflammation of the sesamoids was evident:

> *"I think in those initial stages when it's really pretty painful, immobilising it in any way, shape or form definitely tends to provide quick relief so if that's in a moon boot for a week … that generally works pretty well to help settle things down" (P02).*

Difficulty weight-bearing and suspected fractures were also a common criterion for the use of a moonboot:

> *"I have moon booted a few just to get through that ultrasound to rule out if I suspected a fracture" (P05).*

Some podiatrists also discussed the incorporation of felt padding into the moonboot to provide further pressure redistribution. Others placed a prefabricated orthotic into the moonboot above the liner:

> *"It works really well and from an ACC perspective, there's a different code for the moon boot so you can do both" (P09).*

Localised sesamoid offloading strategies

Padding, using either semi-compressed felt or poron, was used by many participants as a temporary offloading technique, often used at the initial consultation, when time constraints were present, or when patients arrived with limited footwear for more permanent offloading options:

> *"Patient turns up and there's no way you're gonna get a prefab or something into a [dress] shoe, so just a simple offloading principle as soon as you can, if there's no other option. Certainly it's only a very temporary method because most of that padding will break down" (P11).*

Podiatrists described applying temporary padding to the sock liner of the shoe or directly onto the patient's foot.

Orthoses were used for more permanent offloading of the sesamoid area including plantar 'U' covers, first ray cut-outs, and metatarsal domes. The decision-making process guiding orthotic modifications for offloading was dependent on a combined analysis of the anatomy, function, symptom severity, and the podiatrist's specific goals:

> *"I'd probably describe it as part art form, part science, particularly when you're making an orthotic" (P11).*

Reverse Morton's were often combined with arch fill to redistribute pressure from the sesamoids to the arch area.

> *"2 to 5s just seem to work. I know they shouldn't but for some reason they seem to work quite well" (P05).*

However, other podiatrists were concerned that this modification would load the area further:

> *"I'd never think to do a reverse Morton's because I'd be too concerned with plantar flexing that first ray, that you would get more pain but obviously that's what seems to be the consensus" (P08).*

Plantar 'U' covers were also a popular medication for offloading of the plantar 1st MTPJ:

> *"For me, typically a 'U' plantar cover would be my first go-to and then orthotic permutations or variations of that" (P04).*

First ray cut-outs were also frequently used, either on their own or in combination with poron fill. The use of metatarsal domes was more inconsistent, with some podiatrists not using them, and others noting their benefit in offloading the area:

> *"… utilising more met domes now than I used to. Been noticing that seems to unload particularly well … a wider MT dome which seems to work a treat, especially if you can see some plantar pressures underneath that first MPJ. I'm quite surprised what that does." (P12).*

Materials were also discussed as an important consideration when constructing orthotic modifications for offloading the sesamoids. EVA was commonly reported as an appropriate material, but the preferred thickness and density varied greatly:

> *"Definitely does depend on the foot that we're seeing. The majority of the time, I'd do a firm density EVA that's relatively thick." (P10).*

Layering of different materials with EVA was also used to offload the plantar 1st MTPJ.

Finally, many podiatrists interviewed also discussed sprig removal in football boots as a mechanism to offload pressures at the plantar 1st MTPJ:

> *"Another thing I often do…with football boots I typically take that cleat out under that first metatarsal phalangeal joint as well" (P08).*

4.5.5 Theme 5: Immobilising the 1st MTPJ and sesamoids

Immobilising the 1st MTPJ and sesamoids was commonly discussed in the focus groups. This was achieved through strapping, the use of a carbon fibre plates, and immobilisation with orthotics.

Strapping

Podiatrists reported using strapping tape as a technique to immobilise and resist movement at the 1st MTPJ, during the propulsive phase of gait:

> *"I strap a lot, try to lift that first ray a little bit so it's not on the sesamoids." (P05).*

Strapping was also used to determine the potential effectiveness of orthotic therapy:

> *"I do a bit of strapping tape as well to reduce the motion of the first MTPJ and if that feels really good then I'll implement that into an orthotic with a Morton's extension or something" (P10).*

Carbon fibre plates

Stiff carbon fibre plates were used when a greater degree of immobilisation was required. The goal of these plates was to stiffen the forefoot and prevent extension at the 1st MTPJ, and therefore loading of the sesamoids. Carbon fibre plates were often used in sporting situations where the forefoot was subject to particularly high loading

> *"… particularly with scrummaging and stuff and rugby players … I've got players that are actually still playing in them all season even though [the ground has] got really soft and they've just been using it cos it gives them some stiffness through scrummaging and changing their load" (P05).*

Carbon fibre was used with caution by some:

> *"I find that carbon inserts can be … if it's not quite shaped to the shoe last, it doesn't feel very comfortable for the patient" (P10).*

Some podiatrists also reported using carbon fibre material with orthotic therapy. One podiatrist described using a stiff gait plate material to construct a kinetic wedge which is placed over foam to create an aperture for the sesamoids

> *"so you're offloading it but you're also stiffening it" (P10).*

However, the use of carbon fibre, particularly when combined with orthotic therapy, was also dependent on the patient's footwear:

> *"I don't find there's enough room for an orthoses either prefab or custom and a carbon plate unless you've got something like a work boot scenario" (P12).*

Immobilisation with orthotics

Morton's extension was reported by some podiatrists as the preferred orthotic modification to immobilise the 1st MTPJ:

> *"Reducing the amount of plantarflexion through that first met and that load going on to that fulcrum point or that pivoting point…is pretty important." (P02).*

However, as the Morton's extension follows the opposite concept to a reverse Morton's (i.e., immobilisation vs. offloading), some podiatrists were uncertain of its mechanism:

> *"Then you told me that I should be doing Morton's extensions so then I was like, maybe I'm doing it all wrong" (P06);*

> *"It's 50/50, you either do a Morton's extension or 2 to 5s [reverse Morton's]. So just try one and if it doesn't work you try the other" (P06).*

However, it was agreed that if Morton's extensions were used, they were temporary:

> *"… we've gotta be careful with treatments as well, in terms of if we restrict one joint and typically what you do with the Morton's extension is we don't open up a can of worms for other injuries or pathologies" (P08).*

Other podiatrists described changing the density of the Morton's extension (usually a hard plastic) to a softer material over time as the sesamoid inflammation reduced, or covering the modification with a softer plantar top cover.

4.5.6 Theme 6: Facilitating efficient sagittal plane motion during gait

Facilitating efficient sagittal plane motion during gait, particularly through the 1st MTPJ, was commonly discussed among the focus groups as an important aspect of the long-term management of sesamoiditis. This was achieved through rocker-sole footwear recommendations, strengthening exercises, and orthotics.

Rocker-sole footwear recommendations

Facilitating a more efficient heel-to-toe gait pattern and propulsion through the 1st MTPJ that didn't overload the area was a key theory influencing many footwear recommendations:

> *"I'm trying to enhance sagittal plane movement to try and move them through that area more quickly or change loading through the forefoot to redistribute load more evenly away from that area. Those are probably the more mid to long term things I'll look at" (P03).*

Podiatrists in this study often recommended shoes with rocker soles to facilitate propulsion through the 1st MTPJ with minimal to no dorsiflexion and therefore loading on the sesamoids:

> *"… the modern footwear with that great little rocker through there makes a massive difference to unloading that joint because minimal extension takes place in the toe when they're walking" (P11).*

Some practitioners recommended specific brands to their patients (Hoka One, Bondi, Speed Goat) dependent on the patient's budget and type of activity:

> *"Shoes in New Zealand cost a bomb, so I use a Bondi, like any of the early-stage rockers. Anyone doing hockey or anything like that, I've used the Speed Goat. I've had a few lacrosse players and I've done the Speed Goat" (P05).*

Strengthening exercises

Inclusion of strengthening exercises targeting the flexor hallucis longus muscle and other intrinsic foot muscle was also discussed by practitioners. Strengthening of the long flexor muscles was believed to encourage more efficient loading through the 1st MTPJ during propulsion:

> *"I've been noticing particularly with chronic plantar first MTPJ pain there seems to be weakness in that long flexor… so been using some TheraBand early on to try and encourage early initial loading through there" (P12).*

Other podiatrists described using towel grip exercises, resisted flexion and spikey ball exercises to increase strength in the intrinsic foot musculature.

Orthotics for efficient propulsion

Long term orthotic modifications were also focused on improving more efficient loading through the 1st MTPJ:

> *"a pretty important one is how effectively or efficiently they move through the sagittal plane and do they stall on that part of their foot. If I'm seeing that kind of stuff, short of going into a rocker, I might*

> *consider something like an orthotic to try and help and facilitate them through that area." (P03).*

Customised plantar metatarsal pads (PMP), kinetic wedges, and metatarsal bars were forefoot orthotic modifications used by participants to help sagittal plane motion:

> *"… using something like a PMP to try and spread load across that part of the foot so that I can allow them to carry continuously through or efficiently through the sagittal plane without excessively placing load on the first MPJ" (P03).*

The podiatrists also recognised the importance of rearfoot posting and the influence that has on forefoot loading:

> *"I might focus a little bit more on the rear foot in terms of trying to unload the medial column of the foot by changing rear foot position to try and allow that person to move efficiently through the forefoot without being excessively on the medial part of the foot" (P03).*

4.5.7 Theme 7: Managing patients who don't respond to podiatry treatment

Referral to wider interdisciplinary team members for further management further was discussed among the participants as an approach the patients who did not respond to podiatry care. Practitioners reported specific time frames for podiatric management before considering referral, but when that time came, were hesitant to refer patients for more invasive procedures.

Knowing when to refer

Most podiatrists in this study reported treating patients for just four to six weeks before considering referral to another practitioner:

> *"Probably after not that long cos I feel like sesamoiditis, you get a fairly quick indication of whether your treatment plans' working but maybe four to six weeks if it wasn't working, I'd go and refer on" (P07).*

However, some practitioners referred earlier to factor in the waiting time to see a sports physician or orthopaedic surgeon:

> *"…knowing how long it takes to get in to see a sports doc, I'd be wanting to think about referring probably at that four-to-five-week mark" (P08).*

Hesitancy in referring for more invasive interventions

When podiatric treatment was not providing symptom relief or resolution, practitioners reported referring to other health providers, including general practitioners, orthopaedic specialists, and sports doctors. However, it was clear among the participants that there was hesitancy in referring for more invasive therapies due to side effects and low success rates and were often only considered as last resorts. One practitioner reported considering referral for an ultrasound guided corticosteroid injection:

> *"Certainly, some consideration … to an ultrasound guided steroid injection – Kenacort probably. Usually not in that first two weeks, I'm talking this is unresolved, the pain scale hasn't changed in four weeks. I'm going why isn't this moving? Why isn't this changing?" (P04).*

Questionable success rates following surgical procedures also reduced referral to orthopaedic specialists:

> *"It would be very rare that I would refer to a surgeon for excising of the sesamoid. I have seen it in my earlier days, and it's never been successful…I find it very difficult to know who I would send them to. If we haven't got the skills to do it ourselves, then there's really only the surgeon and, as I say, I haven't found surgery to be successful for sesamoiditis but maybe I haven't seen enough" (P01).*

Chapter 5 Discussion

This study offers an important contribution to the understanding of sesamoiditis assessment and management by podiatrists in Aotearoa New Zealand. The data collection in the study was comprehensive and produced valuable insights into the practices of podiatrists. Despite the lack of clear guidelines, the study demonstrated that podiatrists in Aotearoa New Zealand possess advanced analytical skills and utilize a thorough approach in their care of patients with sesamoiditis.

In terms of the significance of the research in the discipline area, the findings from this study may be useful in informing the development of guidelines and recommendations for the assessment and management of sesamoiditis. By highlighting the advanced analytical skills and thorough clinical reasoning of podiatrists in Aotearoa New Zealand, the study may also serve as a model for practitioners in other geographical locations. Additionally, the findings of the study highlight the value of the podiatrist and may contribute to the ongoing development and advancement of podiatry as a discipline.

5.1 Assessment of sesamoiditis

A variety of examination techniques were undertaken by Aotearoa New Zealand podiatrists when assessing patients with sesamoiditis. These assessments exemplify how thorough and multifaceted their approach to each sesamoiditis case is. It was clear from the focus group data, that an exhaustive effort is made to understand the patient history, mechanism of injury, foot type, lower limb function, footwear, maximal capacity of muscular force generation, joint range of motion, and possible presence of underlying health conditions that may be complicating their presentation. These findings are consistent with common assessment approaches mentioned briefly in existing literature (Andrews et al., 2021; Pribut, 2010; York et al., 2017) but contribute to new knowledge regarding their application and clinical reasoning. The results from this study highlight that, despite the absence of published guidelines or recommendations, assessment approaches are clinically justified based on a combination of the practitioners' anatomical and biomechanical knowledge and experience.

Of additional interest, was that participants in the current study recognised the value and usefulness of additional assessment techniques available outside of their scope, for example advanced imaging, and did not hesitate to refer patients for additional testing. Plain radiography and MRI is recognised in current literature as the gold standard for imaging of sesamoiditis, with CT scans as the third modality of choice (Chiou et al., 2020; Clough & Majeed, 2018; Kiener et al., 2017; Lombard et al., 2020; Schein et al., 2015; York et al., 2017). Limited scope of practice for podiatrists in Aotearoa New Zealand raises concerns about availability of these imaging techniques. As a result of the inability for direct referrals, patients often face delays in diagnosis, and therefore the ability of the podiatrist to provide timely and effective care.

5.2 Management of sesamoiditis

Participants in the current study reported using a range of management techniques which were informed not only by biomechanical justifications, but also consideration of individual patient factors. It was also clear that a phase-based approach was used in which reduction of inflammation and pain was initially prioritised with offloading therapies, followed by further immobilisation techniques where appropriate. Footwear and orthotic therapy were considered in both short- and long-term plans, but for most patients, the overarching goal was to restore or facilitate efficient sagittal plane function of the foot. These insights greatly advance current understanding of various management techniques described in the literature (Andrews et al., 2021; Chou, 2000; York et al., 2017), including the treatments goals which should encompass sesamoiditis management plans.

As a result of the individualised approach to managing sesamoiditis, treatment plans were well-tailored to the patient. For example, this was evident in the discussions around orthotic prescriptions which were reported to require creativity and innovation in their design; providing valuable commentary that is absent in existing literature (Clough & Majeed, 2018; Schein et al., 2015). Consistent with podiatrists' approaches to assessment, it was clear that sound biomechanical knowledge was required, along with clinical experience that enabled clinicians to adapt their prescriptions over follow up appointments as needed.

Central to practitioner's ability to provide individualised and appropriate treatment, was their consideration of the patients' financial circumstances and the provision of appropriate patient education initial assessment stages right through to the management planning stages. These practices clearly reflect concepts of patient-centred care and emphasise the importance of clear communication that permits patients to make informed decisions about their management.

Studies show that anti-inflammatory drugs and pain relievers are effective for managing inflammatory foot conditions, including plantar heel pain and osteoarthritis (Bounous et al., 2018; Singh et al., 2016). In Aotearoa New Zealand, podiatrists are unable to prescribe these medications, which creates another barrier to effective management of foot conditions, including sesamoiditis. The findings from this study highlight that this podiatrist prescription rights as a key area for development in Aotearoa New Zealand.

Cushioning of the sesamoids and plantar 1st MTPJ were central management strategies in the current study. Off-loading strategies, including the use of orthotics or cast immobilization, are commonly used to reduce pressure, reduce pain, and improve functional outcomes in individuals with plantar heel pain, knee osteoarthritis, and pain in other locations of the foot (Ramaprabhu V et al., 2020; Rathleff et al., 2015; Santosa et al., 2019; Winters et al., 2018). In addition to cushioning, pressure redistribution and offloading of the sesamoids was also an important management strategy. Research has shown that custom and prefabricated orthoses that redistribute pressure away from the injured 1st MTPJ can be effective (Ramaprabhu V et al., 2020; Santosa et al., 2019). Wearing a cast or moonboot to immobilise the area can also help to reduce stress and promote healing (Ramaprabhu V et al., 2020). It has also been well-documented that wearing footwear with a wide and stable base, rocker sole and adequate cushioning can both help to redistribute pressure and reduce stress on the 1st MTPJ (Horn et al., 2016; Winters et al., 2018). Lastly avoiding movements that place excessive forces on the 1st MTPJ can be useful to reduce pain and promote healing (Santosa et al., 2019). Participants in this study reported the use of moonboots, cushioning modalities, and orthotic therapy as management techniques to help redistribute pressure and offload the sesamoids. These decisions effectively are aiming to either redistribute pressure away from injured sesamoids or to provide additional cushioning or padding to the

joint. Further work is required to determine whether specific patent factors are associated with improved effectiveness of one approach compared to the other.

Consistent with the conflicting published evidence on surgical management of sesamoiditis (Taylor et al., 2014), participants in the current study questioned surgical treatment approaches as their experience of patients who undergo surgery rarely report successful outcomes. Similarly, practitioners also appeared hesitant to use injection therapies which were reported to provide temporary relief only. The uncertainty around the efficacy of more invasive therapies meant practitioners were more comfortable exploring long-term management focused on facilitating sufficient sagittal plane motion of the foot as a strategy to prevent ongoing overloading of the sesamoid complex.

5.3 Strengths and limitations

A major strength of this study was the rigorous approach to the design, analysis, and interpretation of the study. The focus groups were facilitated by an experienced podiatric clinician who was familiar with podiatric terminology and easily able to control and manage the discussions to ensure they were focused on the research questions. A potential limitation of the study was the influence of the primary researcher's own perspectives and biases. However, these were clearly defined and acknowledged during the design, analysis, and interpretations stages. Furthermore, reflexive thematic analysis recognises that the research occurs because of the researcher's subjectivity/bias (values, backgrounds, decisions, and interests) and does not attempt to remove it (Terry & Hayfield, 2021). As this study only included podiatrists currently practicing in Aotearoa New Zealand, their experiences may be reflected of the geographical location, cultural factors, and health care system that are specific to this location. Therefore, the experiences of the participants in this study may not be reflective of all global populations.

5.4 Recommendations for clinical practice

It is clear from previous literature and the results from the current study, that podiatrists play an important role in assessing and managing sesamoiditis, and less experienced clinicians may find the results from this study useful in informing their

own practice. The findings from this study have shown that podiatrists have extensive skills and knowledge to treat sesamoiditis. Perhaps the promotion of their scope among the interdisciplinary team will allow for more timely referrals and management.

Facilitating, or if possible, restoring sagittal plane motion for effective propulsion appears to be an important treatment goal when managing patients with sesamoiditis. Podiatric treatment options that are directed towards achieving this should therefore be captured in long term management plans. Surgical interventions often oppose this approach, and it is possible that this contributes to the unsuccessful surgical outcomes and greater post-operative mobility issues. Radial soundwave therapy (Saxena et al., 2016) and injection therapies (de Oliveira Beraldo et al., 2020; York et al., 2017) may be a better alternatives to surgical options, as they have lower risks of inhibiting sagittal plane motion post-treatment.

5.5 Future directions

The current study has highlighted the barriers and challenges faced by podiatrists due to various health system restrictions. Systematic changes to the Aotearoa New Zealand health sector that enable podiatrists to refer for blood tests, prescription medication, and imaging access to CT and MRIs should be considered under the public sector and ACC funding pathways. It is evident from this study that podiatrists are leading in their approach to conservative assessment and management of sesamoiditis. They have advanced analytical skills, clinical reasoning, and a strong anatomical knowledge base that allows them to provide sound advice and skills to help manage this condition. Facilitating easier access to resources, particularly those within their scope of practice will improve overall patient outcomes. Legislative and policy-based restrictions should not be a barrier for clinicians as timely and appropriate treatment is necessary to reduce social implications that arise from long-term mismanagement where an inability to walk and move is a higher burden in many aspects.

Suggestions by de Oliveira Beraldo et al. (2020) of sesamoiditis being an inflammatory condition that affects the hallux sesamoid bones were challenged by the participants of this study. Chou (2000) definition of inflammation of sesamoid bones with the presence of the joint capsule presenting acutely or chronically were supported by this study's finding. It was argued that sesamoid bone inflammation clinically does not

occur alone, there is almost always involvement of soft tissue pathology changes present in changes of sesamoiditis. The combination of this inflammation of both 1st MPJ soft tissue and hallux sesamoids in combination which causes 1st MTPJ function inhibition is sesamoiditis. Based on these perceptions of the participants in this study, further work may be needed to develop a consensus-based definition/label such as a Delphi study for sesamoiditis that accurately captures its pathological process, similar to the work undertaken by Chiou et al. (2020) who provided a review and grading definition of Turf Toe injuries involving the 1st MTPJ.

Finally, further research, specifically intervention studies or randomised controlled trials, are needed to determine the effectiveness of various conservative interventions for sesamoiditis. This information can then be used to develop evidence based clinical practice guidelines and recommendations for podiatrists to use when managing people with sesamoiditis. Further research, similar to that conducted by Dean et al. (2020), may also explore the efficacy of a multifaceted approach to surgical intervention which encompasses a post-operative rehabilitation program.

5.6 Conclusion

This research project allowed an in-depth exploration of the perceptions and experiences of podiatric clinicians on their assessment and management approaches for sesamoiditis. This results from this study highlight the valuable role of the podiatrist and their ability to draw on their advanced anatomical knowledge and clinical reasoning skills to improve patient outcomes. Despite the absence of any clear guidelines or recommendations for assessing and managing sesamoiditis, this study has shown that podiatrists have the ability to overcome health system barriers and patient challenges to provide individualised management plans that are appropriate for the patient. The findings from this study may be useful for less experienced practitioners in their assessment and management of sesamoiditis by providing a detailed description of the podiatrist's experiencing with this condition, which was previously absent from published literature.

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Appendices

Appendix A *Participant Information Sheet and Consent Form*

Participant Information Sheet

Date Information Sheet Produced:

15/03/2022

Project Title

Podiatric assessment and management of sesamoiditis

Kia ora

My name is Preeti Kaur, and I am a New Zealand registered podiatrist, currently undertaking my Master of Health Practice in Podiatry at Auckland University of Technology (AUT). As part of this qualification, I would like to invite you to participate in a research study which aims to explore the assessment and management approaches used by New Zealand podiatrists for patients with sesamoiditis.

What is the purpose of this research?

Sesamoiditis is a common inflammatory condition affecting the first metatarsophalangeal joint (big toe). There is currently an absence of clinical guidelines and recommendations informing the assessment and management of this condition. As part of this research, I will be running small focus group discussions (approximately 3-4 podiatrists per group) to obtain an understanding of the clinical assessments and management strategies used by podiatrists in New Zealand Aotearoa for patients with sesamoiditis. Results from this study may aid in the development of recommendations that help guide podiatric assessment and management of this condition. The findings of this research may be used for academic publications and presentations.

How was I identified and why am I being invited to participate in this research?

You have been invited to participate in this research study because you are registered with the New Zealand Podiatry Board and have responded to an advert placed in their recent Newsletter. To be eligible to participate, you must be a registered New Zealand podiatrist, have at least five years of clinical podiatry experience, and your caseload must comprise predominantly of sports podiatry (i.e., >60% patients with biomechanical/ musculoskeletal/ ACC injuries).

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. If you choose to participate, you will need to complete a Consent Form (attached to the end page of this document) and return it to Preeti Kaur (contact details below). You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

What will happen in this research?

If you agree to participate, you will be invited to take part in a small focus group discussion with 2 to 3 other podiatrists like yourself. The focus group will take place online via Zoom and will take approximately 60 minutes. The focus groups will be facilitated by the primary researcher (Preeti Kaur) and will cover the assessment and management approaches used to treat sesamoiditis. The goal is to provide a comfortable and casual place to share your experiences and opinions without judgement.

What are the discomforts and risks and how will they be alleviated?

It is not expected that participation in this study will cause any discomforts or risk as the focus group discussions are not aimed to elicit any personal information. However, if any discomfort or risk is felt, you can withdraw from the focus group discussion at any time or you can decide not to answer a particular question. You do not need to give a reason why.

What are the benefits?

This study will provide valuable information about the approaches used by New Zealand Podiatrists to assess and manage sesamoiditis. The findings from this study have the potential to direct future development of assessment and treatment guidelines that can be used to improve the care patients with sesamoiditis receive.

How will my privacy be protected?

The focus group conversations are audio recorded and will be transcribed verbatim (word-for-word). To protect your confidently, no real names or other identifiable information will be used in the transcriptions. Your identity will never be revealed in any publications or presentation arising from this study. All data, including Consent Forms, will be kept secure in a locked filing cabinet and destroyed ten years after completion of the study. Because of the nature of group discussion, what you say during the focus group will be known to other participants in the focus group. We therefore ask that participants respect the privacy and confidentiality of others in the group.

What are the costs of participating in this research?

The only cost for you is 60 minutes of your time to participate in the focus group discussion. You will be reimbursed for your time and participation with a $30 Westfield or Countdown voucher.

What opportunity do I have to consider this invitation?

You will have two weeks to consider this invitation.

Will I receive feedback on the results of this research?

If you would like to receive a summary of the results from this research, please let me know by indicating so on the relevant section of the Consent Form.

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 Sarah Stewart, sarah.stewart@aut.ac.nz, (09) 921 9999 ext 5451*.

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?

If you would like to participate in this study or have any questions about the study, please contact the primary researcher, Preeti Kaur, using the contact details below:

Researcher Contact Details:

Preeti Kaur: cyk9981@autuni.ac.nz

Project Supervisor Contact Details:

Dr Sarah Stewart: sarah.stewart@aut.ac.nz, (09) 921 9999 ext 5451

Approved by the Auckland University of Technology Ethics Committee on *12 April 2022*, AUTEC Reference number *22/72*.

Consent Form

Project title: ***Podiatric assessment and management of sesamoiditis***

Project Supervisors: ***Dr Sarah Stewart, Associate Professor Matthew Carroll***

Researcher: ***Preeti Kaur***

- ○ I have read and understood the information provided about this research project in the Information Sheet dated 22 February 2022.
- ○ I have had an opportunity to ask questions and to have them answered.
- ○ I understand that identity of my fellow participants and our discussions in the focus group is confidential to the group, and I agree to keep this information confidential.
- ○ I understand that notes will be taken during the focus group and that it will also be audio-taped and transcribed.
- ○ I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.
- ○ I understand that if I withdraw from the study then, while it may not be possible to destroy all records of the focus group discussion of which I was part, I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.
- ○ I agree to take part in this research.
- ○ I wish to receive a summary of the research findings (please tick one): Yes○ No○

Participant's signature : .....

Participant's name : .....

Participant's Contact Details (if appropriate):

.....

.....

.....

.....

Date : .....

Approved by the Auckland University of Technology Ethics Committee on 12 April 2022 AUTEC Reference number 22/72

Note: The Participant should retain a copy of this form.

Appendix B *Focus group schedule*

FOCUS GROUP QUESTION SCHEDULE

The following focus group schedule will be used by the facilitator as a guide only. Possible prompts are also suggested below and may be used, as required, to facilitate the discussion.

[Facilitator's introduction to focus group]:

Welcome to you all. Firstly, I'd like to thank you for your time and your interest in my research. I'm Preeti, a registered podiatrist, and will be the facilitator for this discussion. I have been in private practice now for seven years and am very much interested in forefoot injuries with a keen interest in sesamoid injuries. The goal of this discussion is to share your thoughts and experiences around the assessment and management of sesamoiditis. Just to remind you – our discussion today will be recorded, but all the data will be de-identified to ensure that you are not identified personally in any report/publication arising from the research.

Some ground rules I'd like to mention before we start:

- There are no right or wrong answers. I encourage you to speak freely today during our discussions.
- Everyone's opinions are valuable.
- Please respect the opinions of each other.
- You don't need to contribute to a specific question if you don't feel comfortable
- Please avoid sharing sensitive/personal information about specific patients.

Does anyone have any questions or queries before we start?

[Participant introductions]:

We'll now go around, and I'd like everyone to have turns to introduce yourself. If you could tell us your name, how long have you been practicing podiatry, where in Aotearoa New Zealand do you practice and what your typical case load looks like (i.e., general care, sports, paediatrics, etc).

[Opening questions]:

1. How often do you come across 1st MTPJ injuries in your practice?
   - *Prompts: For example, how many cases would you come across each week, month or year, or what proportion of your case load would have 1MTPJ injuries?*
2. How often are these 1st MTPJ injuries diagnosed as sesamoiditis?
3. How would you define sesamoiditis?
4. Is sesamoiditis something you tend to diagnose provisionally or differentially in your practice?

[PART A Key Questions related to assessment approaches]:

1. What assessments do you perform to assist you with diagnosing sesamoiditis?
   - *Prompts: palpation, observations, subjective history, imaging, range of motion tests, strength testing, pressure analysis, gait analysis, outcome measures, pain scales…*
2. How do you interpret the findings of these assessments to reach a diagnosis?
3. Is there any assessment(s) that you think is most helpful in diagnosing sesamoiditis?
4. Are there any other conditions that you are trying to rule out when performing these assessments?
   - *Prompts: turf toe, gout flare…*
5. Is there anything else you use to assist you in reaching a diagnosis?
   - *Prompts: specific subjective information from the patient (i.e., mechanism of injury), referral for imaging, discussion with a colleague....*

[PART B Key Questions related to management approaches]:

1. How do you usually manage a patient with sesamoiditis – what treatment tools do you use in the short-term?
   - *Prompts: Offloading? Taping? Orthotics? Strength training? Stretches? Needing? Braces? Splints? Footwear? Insole modifications (felt or materials)? Moonboot/Square shoe/Forefoot offloading shoe? Massaging/soft tissue work? Avoidance of certain activities? Activity modification? Shockwave or radial therapy? Education?*
2. What treatment tools do you use in the long-term management?
   - *Prompts: as above*
3. What influences your decision to opt for a specific treatment tool?
   - *Prompts: For example, what characteristics/qualities would qualify for you to make the decision to use orthotic therapy for one patient and a moon boot for another?*
4. In your opinion, which treatment tool have you had most success with when managing a sesamoiditis case?
   - *Prompts: Do you have any working theories on how this may help your patients?*
5. If you use orthotic therapy, can you describe the modifications and materials you use?
   - *Prompts: forefoot modifications (Morton's extension, cluffy extension, kinetic wedge, reverse 'c' plantar pad, 'u' cut out plantar pad, plantar pad, MT dome, MT bar), midfoot (arch fill), rearfoot (varus, valgus, heel rise, heel cushion) …*

- *Prompts: shell materials (semi-custom, function orthoses), poron (slow release, standard), EVA (220, 330, 350, etc), multiform, other foams, 3D, polypropylene, LDPE…*

6. At what point would you refer a patient to for more invasive/non-conservative treatment options?
   - *Prompts: after 3 months, 6 months, etc, of no improvement in symptoms?*

[Concluding Question]:

Thank you all for your valuable input. This discussion has been very insightful. Just to summarise the main points from our discussion … [researcher to summarise discussion points].

To finish off, I'd like us all to have a turn at sharing any final comments on what you thought was the most important points from this discussion, or if there is anything else you would like to add that we haven't covered yet?

[Additional prompting Questions/Phrases that may be used]:

- Could you tell us more about this…?
- What prompted you to do this/take this approach…?
- What characteristics drew you to…."x" ….?
- Interesting…when you think back to this time…is there any features or qualities you identify?
- Thank you for your input, it's great.
- How do you feel about…"x" ….?
- When you say…."x". What is your thought process behind this statement?
- In your opinion…would you say this is a challenge or an advantage?
- When do you seek a second opinion or further investigations/referrals?
- What resources did you wish you had access to?
- What qualities limited you…
- What features enabled you…

Appendix C *AUT Ethics Committee 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

12 April 2022

Sarah Stewart
Faculty of Health and Environmental Sciences

Dear Sarah

Re Ethics Application: **22/72 Podiatric assessment and management of sesamoiditis in Aotearoa New Zealand**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 12 April 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: punjabunkuripreeti@hotmail.com; matthew.carroll@aut.ac.nz;