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Delphi Consensus on the Standardization of Assessment and Treatment Approaches for Patellofemoral Pain Syndrome

Patellofemoral Ağrı Sendromunda Değerlendirme ve Tedavi Yaklaşımlarının Standardizasyonu: Bir Delphi Konsensusu

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ABSTRACT

Objective: Patellofemoral pain syndrome (PFPS) is a common knee problem that affects young and active individuals and can significantly limit daily life activities. Discrepancies exist between the assessment and treatment approaches described in the literature and those applied in clinical practice. To establish expert consensus on the standardization of PFPS assessment, treatment approaches, and discharge criteria commonly applied in clinical settings.

Methods: A two-round Delphi survey was conducted among physiotherapists and researchers with at least one year of PFPS experience. The first-round questionnaire comprised 106 items. Items that reached 75% or greater agreement on a 4-point Likert scale were considered to have achieved consensus. In the second round, items without consensus were re-evaluated following group feedback.

Results: The study involved 34 experts in Round 1 and 31 experts in Round 2. The process resulted in expert agreement on 76 out of 106 items (71.7%). The assessment parameters of pain-aggravating activities and stair climbing and pain localization and muscle strength, and daily living capability received more than 95% agreement. The treatment methods that received the most support from experts included quadriceps strengthening and open kinetic chain exercises and electrotherapy and patellar mobilization, and kinesiotaping (KT). The assessment of pain-free jumping proved to be the most effective indicator for determining functional recovery among discharge criteria.

Conclusion: The research established evidence-based management guidelines for PFPS through expert consensus, which created standardized clinical priorities. Additional research needs to build upon these results to create dependable diagnostic and therapeutic methods.

Keywords: Patellofemoral pain syndrome, delphi technique, standardization, consensus, rehabilitation.

ÖZ

Amaç: Patellofemoral ağrı sendromu (PFAS), genç ve aktif bireylerde sık görülen, günlük yaşam aktivitelerini önemli ölçüde kısıtlayabilen bir diz problemidir. Literatürde tanımlanan değerlendirme ve tedavi yaklaşımları ile klinik uygulamalarda kullanılan yöntemler arasında belirgin farklılıklar bulunmaktadır. Bu çalışmanın amacı, klinik uygulamalarda yaygın olarak kullanılan PFAS değerlendirme yöntemleri, tedavi yaklaşımları ve taburculuk kriterleri üzerine uzman görüş birliği sağlamaktır.

Yöntem: Çalışma, PFAS alanında en az bir yıllık klinik deneyimi veya araştırma geçmişi olan fizyoterapist ve araştırmacılarla yürütülen iki tur Delphi anketi şeklinde tasarlanmıştır. İlk tur anketinde toplam 106 madde yer almıştır. Dört basamaklı Likert ölçeğinde %75 ve üzeri uzlaşı sağlanan maddeler konsensus olarak kabul edilmiştir. İkinci turda ise konsensusa ulaşmayan maddeler, grup geri bildirimi eşliğinde yeniden değerlendirilmiştir.

Bulgular: İlk turda 34, ikinci turda ise 31 uzman yer almıştır. Süreç sonunda 106 maddenin 76'sında (%71,7) uzlaşı sağlanmıştır. Ağrıyı artıran aktiviteler, merdiven inip-çıkma, ağrının lokalizasyonu, kas kuvveti ve günlük yaşam aktivitelerinin değerlendirilmesi en yüksek düzeyde görüş birliği elde edilen parametreler olmuştur. Tedavi yaklaşımları arasında quadriceps güçlendirme, açık kinetik zincir egzersizleri, elektroterapi, patellar mobilizasyon ve kinesiotaping (KT) en fazla destek gören yöntemlerdir. Taburculuk kriterleri arasında, ağrısız sıçrama değerlendirmesi fonksiyonel iyileşmenin en güvenilir göstergesi olarak öne çıkmıştır.

Sonuç: Bu çalışma, uzman konsensusu aracılığıyla PFAS yönetiminde kanıta dayalı standart klinik öncelikleri ortaya koymuş ve gelecekte geliştirilecek tanı ve tedavi protokolleri için güçlü bir temel oluşturmuştur.

Anahtar kelimeler: Patellofemoral ağrı sendromu, delphi tekniği, standardizasyon, konsensus, rehabilitasyon.

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1. INTRODUCTION

The medical literature shows that PFPS affects between 20% and 40% of knee disorders (Crossley et al., 2016; Décary et al., 2018; van Middelkoop et al., 2008). Current studies report that the prevalence of PFPS in the general population is 22–23% (Dey et al., 2016; Smith et al., 2018). People who have PFPS experience restricted movement during their daily activities. The typical symptoms of PFPS patients include patellar pain, which occurs either in front of or behind the patella during activities that stress or compress the patellofemoral joint, such as stair climbing and sitting to standing and squatting and jumping and running (Collins et al., 2013; Crossley et al., 2016; Lankhorst et al., 2016; Witvrouw et al., 2014).

PFPS prognosis shows a negative trend regardless of patient age or sex or physical characteristics according to research findings. The literature shows that PFPS is a multifactorial condition that combines biomechanical factors with neuromuscular elements and psychosocial aspects (Collins et al., 2010; Rathleff et al., 2014; Willy et al., 2019). The assessment and treatment process for PFPS symptoms should begin immediately after their first appearance (Collins et al., 2010). The variety of assessment and therapeutic techniques used by physiotherapists reflects the lack of standardization in clinical practice (Wallis et al., 2021).

A guideline published in 2024 reported that treatment approaches such as hip – and knee-focused exercises, biofeedback targeting the vastus medialis muscle, invasive methods such as dry needling and injections, various taping techniques, and prefabricated foot orthoses are supported by low levels of evidence and have not been widely debated among experts (Neal et al., 2024). However, the frequent use of these methods in clinical practice creates a gap between the literature and clinical application. The results based on expert knowledge and experience can help determine the likelihood of acceptance of healthcare interventions (Spranger et al., 2022). The Delphi method is a technique used to reach expert consensus on a particular subject (McKenna, 1994; Rowe & Wright, 1999). The present study was designed to reach expert consensus via the Delphi method to address the uncertainties in the assessment and treatment of PFPS.

2. MATERIAL AND METHOD

2.1. Study Design

The research used a two-round modified Delphi method to achieve expert consensus about PFPS clinical assessment and treatment approaches from April 2024 to June 2025.

The RAND Corporation developed the Delphi technique in the 1950s as a method to collect expert opinions through multiple feedback rounds while protecting participants' identities. Healthcare professionals use this research approach to create clinical guidelines, standardize practices and detect areas where empirical consensus is absent (Dalkey & Helmer, 1963).

This study used the Delphi method to gather expert opinions on PFPS symptoms, clinical assessment methods, therapeutic approaches, and discharge criteria. The research design consisted of two consecutive online survey sessions. The participants assessed all the items through a 4-point Likert scale during the first round. The participants received the same items for re-evaluation in the second round to achieve consensus through opinion refinement. In the second round of evaluation, the participants received average scores from the first round to report their subsequent responses.

2.2. Participants

The study included licensed physiotherapists with at least one year of clinical or scholarly experience working with patients with PFPS and were actively involved in musculoskeletal rehabilitation in Iran and Turkey. This constituted a single-stakeholder expert panel (physiotherapists) focused on musculoskeletal rehabilitation. The study included participants with varying experience levels who worked in academic and clinical environments to obtain complete expert opinions.

No a priori statistical power analysis was undertaken because Delphi studies do not test an inferential hypothesis. Instead, panel size was pre-specified from methodological guidance with the aim of achieving stable, replicable consensus. Given the single-stakeholder (physiotherapists) nature of the panel, contemporary evidence indicates that samples of approximately 20–30 experts are generally sufficient to yield replicable results, whereas multistakeholder panels typically require larger samples (≈60–80) (Manyara et al., 2024). Accordingly, to accommodate anticipated nonresponse and attrition, invitations were extended to 52 eligible physiotherapists for Round 1.

The researchers contacted participants through their professional connections and institutional ties before they gave electronic consent to start the first round of the study. The researchers protected participant anonymity and data confidentiality throughout the Delphi process while storing all data securely for scientific research purposes only.

2.3. Questionnaire development

The Delphi study questionnaire underwent development through multiple stages, which included scientific literature analysis of PFPS and expert consultations with clinical and academic professionals in musculoskeletal rehabilitation. The goal was to develop an item set that represents current knowledge and clinical practice regarding PFPS assessment and treatment. The initial item collection originated from one academic professor and four practicing physiotherapists who were pursuing their master's degrees. The team started by reviewing PFPS literature to identify assessment methods and treatment protocols, and discharge criteria, which they used to create candidate concepts. The team reviewed the draft items written in English before eliminating duplicate content and making necessary changes to enhance both understanding and clinical application.

The final questionnaire included 106 items, which were divided into three sections: assessment (61 items) and treatment (36 items) approaches and treatment discharge criteria (9 items). The items presented clear evidence-based statements, which participants evaluated via a 4-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree". All items, instructions, and communications were authored and administered in English.

The questionnaire was administered via Google Forms, which participants accessed through electronic distribution. The complete questionnaire content appears in Additional File 1 to provide transparency and ensure reproducibility.

Two independent musculoskeletal rehabilitation experts evaluated the initial questionnaire to enhance content validity by appraising clarity, content relevance, and coverage; minimal linguistic and structural adjustments were implemented before Round 1. Between rounds, feedback was statistical and item-specific: after Round 1, participants received for each item (i) the percentage agreement and (ii) a donut chart showing the full four-category response distribution.The first round of data collection began after the researchers implemented minor linguistic and structural changes on the basis of expert feedback.

2.4. Data collection procedure

The research data collection spanned two rounds of a modified Delphi process from April 2024 to June 2025. The survey link reached participants through email before they had two weeks to finish each round, and additional reminders were sent to increase participation.

We used a 4-point Likert scale ("Strongly Disagree", "Disagree", "Agree", "Strongly Agree") to avoid a neutral midpoint and to encourage decisive expert judgements toward consensus (pre-specified at ≥75% agreement) (Chyung et al., 2017; Lange et al., 2020). In studies such as ours, where neutral responses are deemed unhelpful for the specific objectives, Delphi studies using 4-point Likert scales have been demonstrated to be effective; furthermore, 4-point formats can yield a similar proportion of items reaching consensus compared with nine-point scales in some applications (Staniszewska et al., 2024; Taylor, 2020).

The research data collection spanned two rounds of a modified Delphi process from April 2024 to June 2025. The survey link reached participants through email before they had two weeks to finish each round, and additional reminders were sent to increase participation.

In the first round, participants were asked to evaluate all the items on a 4-point Likert scale. The participants received anonymized feedback reports containing aggregated results along with percentage agreement calculations after finishing their work. The group's consensus levels for each item were presented to participants before the start of the second round.

The same items were presented to participants during the second round for re-evaluation after they received group feedback to help them modify their previous responses.

In the first round, participants were asked to evaluate all the items on a 4-point Likert scale. The participants received anonymized feedback reports containing aggregated results along with percentage agreement calculations after finishing their work. The group's consensus levels for each item were presented to participants before the start of the second round.

Although participants were explicitly invited to suggest changes to the form after Round 1, no expert suggested adding a "neutral/undecided" option. Accordingly, we maintained the 4-point format (no midpoint) in Round 2 and provided group-level feedback and response distributions for each item.

2.5. Consensus Criteria

Various consensus thresholds have been reported in Delphi studies, ranging widely depending on the research context. Earlier studies have accepted consensus levels as low as 51% (Loughlin & Moore, 1979), whereas other studies have used thresholds of 70% (Meshkat et al., 2014; Williams & Webb, 1994) or 80% (Stewart et al., 2017; Veraar et al., 2018). However, a consensus threshold of 75% agreement is most commonly recommended in healthcare research to balance methodological rigor and practical feasibility (Diamond et al., 2014).

In the present study, consensus was defined as at least 75% of participants rating items within the top two points of the 4-point Likert scale, indicating agreement or strong agreement. Items that reached this threshold after the second Delphi round were considered to have achieved consensus and were included in the final recommendations. Items that failed to meet these criteria were excluded.

2.6. Ethical Considerations

The Ethics Committee of the Faculty of Health Sciences at Marmara University approved this study in 2022 (Approval No. 29.12.2022/160). Prior to participation, all individuals received detailed information about the study's objectives and procedures and provided electronic informed consent in accordance with the ethical standards of the Declaration of Helsinki.

Participation was entirely voluntary, and participants were informed of their right to withdraw from the study at any time without facing any negative consequences.

3. RESULTS

The questionnaire was sent to 52 experts, and 34 participants from Iran and Turkey completed the first round. In the second round, 31 experts responded (Figure 1). The professions of the participants are provided in Table 1, and the mean ± standard deviation (SD) years of experience was 6.2 ± 5.3 years. The majority of participants (approximately 71%) reported between 1 and 5 years of PFPS-related experience, while a significant number of participants (approximately 26.47%) had more than 10 years of academic or clinical expertise.

Table 1. *Professional Background of Delphi Participants*

Profession	Round 1 n (%)	Round 2 n (%)
Researcher (PhD)	4 (11.8%)	1 (3.2%)
Clinician Physiotherapist	30 (88.2%)	30 (96.77%)
Total	34 (100%)	31 (100%)

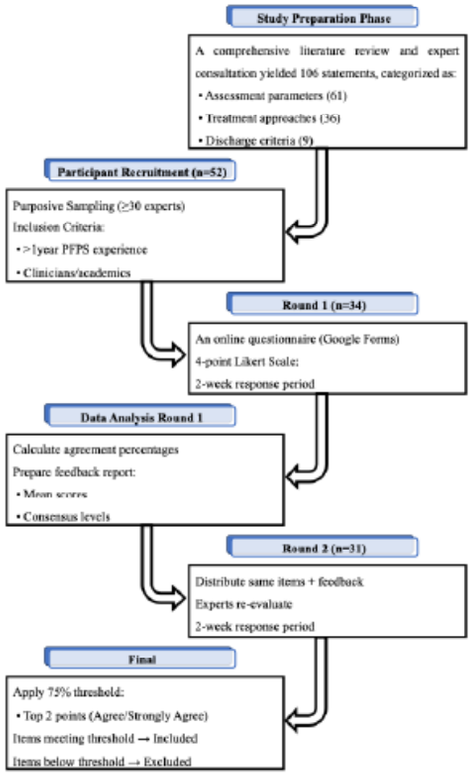

Figure 1. *Flow diagram of our study.*

3.1. First Round Findings

The first-round questionnaire reached 34 expert participants through electronic distribution. All 106 items were evaluated by participants via a 4-point Likert scale. The first round ended with 61 items (59.2%) reached the predetermined consensus threshold of ≥75% agreement. The assessment parameters domain achieved consensus for 35 items (57.38%), the treatment approaches domain reached consensus for 20 items (55.55%), and the discharge criteria domain achieved consensus for 6 items (66.67%) (Table 2, Table 3, Table 4).

Table 2. First *and second round agreement percentages for assessment parameters domain*

Assessment	Round 1 (% Agreement*)	Round 2 (% Agreement*)	Trend Analysis
Patellar Provocation Test	82.4	90.3	↑ 7.9
Double Leg Squat Test	73.5	80.6	↑ 7.1
Single Leg Squat Test	64.7	83.9	↑ 19.2
Step Down Test	64.7	77.4	↑ 12.7
Patellar Tilt Test	76.4	80.6	↑ 4.2
Clark's Sign (Patellar Grind Test)	88.3	90.4	↑ 2.1
Patellar Glide Test	82.4	87.1	↑ 4.7
Daily Living Activities Difficulty in PFPS Diagnosis	91.2	96.8	↑ 5.6
Pain during running and jumping activities	94.1	93.5	↓ 0.6
Activities that aggravate pain	97.1	100	↑ 2.9
Crepitus in the knee	70.6	80.7	↑ 10.1
Pain around the knee	88.2	96.8	↑ 8.6
Grinding sensation in the knee	70.6	90.3	↑ 19.7
Pain while descending slopes	85.3	96.7	↑ 11.4
Ascending and descending stairs	91.2	100	↑ 8.8
Use the Visual Analog Scale (VAS)	82.3	90.3	↑ 8
Gait Analysis	85.3	80.6	↓ 4.7
Biomechanics Analysis	82.4	90.3	↑ 7.9
Assess Flexibility	76.5	90.3	↑ 13.8
Use Foot Analysis	70.6	83.9	↑ 13.3
Assess Shoe Usage	82.3	93.5	↑ 11.2
Assess Bilateral/Unilateral Involvement	85.2	90.4	↑ 5.2
Use Demographic Information	91.2	100	↑ 8.8
Use the Patient's History	91.2	96.8	↑ 5.6
Assess Pain Severity	91.1	93.5	↑ 2.4
Assess the Location of Pain	100	100	0
Assess the Q-angle	82.3	87.1	↑ 4.8
Assess the Joint ROM	79.4	87.1	↑ 7.7
Assess Muscle Strength	91.2	100	↑ 8.8
Use Posture Assessment	82.3	83.9	↑ 1.6
Assess joint ROM for the knee joint	79.4	83.9	↑ 4.5
Assess joint ROM for the hip joint	79.4	77.4	↓ 2
Assess joint ROM for the ankle joint	76.5	80.6	↑ 4.1
Assess the strength of the quadriceps muscle	91.2	96.8	↑ 5.6
Assess the strength of the hamstring muscle	79.4	87.1	↑ 7.7
Assess the strength of the Gluteus Maximus muscle	76.5	83.9	↑ 7.4
Assess the strength of the Gluteus Medius muscle	73.5	93.5	↑ 20
Assess the strength of the TFL muscle	79.4	87.1	↑ 7.7
Assess the strength of the gastrocnemius muscle	73.5	77.4	↑ 3.9
Measure the strength of the hip flexor muscle	70.6	83.9	↑ 13.3
Measure the strength of the hip adductor muscle	79.4	89.5	↑ 10.1
Assess the flexibility of the hamstring muscle	88.2	96.8	↑ 8.6
Assess the flexibility of the TFL muscle	82.4	93.5	↑ 11.1
Assess the flexibility of the gastrocnemius muscle	76.5	87.1	↑ 10.6

% Agreement: percentage of participants selecting "agree" or "strongly agree" on the 4-point Likert scale;
↑: Increase in agreement from Round 1 to Round 2; ↓: Decrease in agreement from Round 1 to Round 2

***Table 3. First** and second round agreement percentages for treatment approaches domain*

Treatment	Round 1 (% Agreement*)	Round 2 (% Agreement*)	Trend Analysis
Use cold application	88.2	93.5	↑ 5.3
Use kinesiotape	88.3	96.8	↑ 8.5
Use electrotherapy agents in the clinic	97.1	96.8	↓ 0.3
Use patellar mobilization	97.1	96.8	↓ 0.3
Use dry needling	82.3	64.5	↓ 17.8
Use friction massage	67.6	77.4	↑ 9.8
Use TFL stretching	91.2	93.5	↑ 2.3
Use gastro-soleus stretching	91.2	90.3	↓ 0.9
Use hamstring stretching	94.1	90.3	↓ 3.8
Use proprioception training	91.2	83.9	↓ 7.3
Use core stabilization training	85.3	90.3	↑ 5
Use quadriceps strengthening	97.1	100	↑ 2.9
Use closed kinetic chain exercises	82.4	93.5	↑ 11.1
Use open kinetic chain exercises	94.1	100	↑ 5.9
Use gait training	88.3	80.7	↓ 7.6
Use foot ankle exercises	79.4	90.3	↑ 10.9
Use gluteal muscle strengthening	91.2	93.5	↑ 2.3
Use pes anserinus release	82.4	83.9	↑ 1.5
Use perturbation training	73.5	77.4	↑ 3.9
Use a Laser	88.2	90.3	↑ 2.1
Use Neuromuscular Electrical Stimulation (NMES)	91.2	93.5	↑ 2.3
Use resistance band training	88.3	96.8	↑ 8.5
Use free weights	70.6	93.5	↑ 22.9
Use a sandbag	70.6	83.9	↑ 13.3
Use manual resistance	61.8	77.4	↑ 15.6

% Agreement: percentage of participants selecting "agree" or "strongly agree" on the 4-point Likert scale;

↑: Increase in agreement from Round 1 to Round 2; ↓: Decrease in agreement from Round 1 to Round 2

***Table 4. First** and second round agreement percentages for Treatment discharge criteria criteria domain*

Treatment discharge criteria	Round 1 (% Agreement*)	Round 2 (% Agreement*)	Trend Analysis
Achieving the same level of muscle strength in the unaffected extremity	70.6	77.4	↑ 6.8
Absence of pain in clinical tests	88.2	90.3	↑ 2.1
Pain-free jumping	88.2	96.8	↑ 8.6
Pain-free running	85.3	90.3	↑ 5
Pain-free stair climbing	88.2	93.5	↑ 5.3
A VAS score of 2 or below for nighttime pain	73.5	87.1	↑ 13.6
A VAS score of 2 or below during activity	82.4	90.3	↑ 7.9
A VAS score of 2 or below during sports	88.2	87.1	↓1.1

% Agreement: percentage of participants selecting "agree" or "strongly agree" on the 4-point Likert scale;

↑: Increase in agreement from Round 1 to Round 2; ↓: Decrease in agreement from Round 1 to Round 2

The assessment items "Assess the location of pain" and "Evaluate activities that aggravate pain" received the highest agreement rates at 100% and 97.1%, respectively. The core treatment interventions received strong consensus from experts because they supported the use of electrotherapy agents in clinical settings (97.1%), patellar mobilization techniques (97.1%) and quadriceps strengthening exercises (97.1%).

The remaining 42 items (40.8%), comprising all the discharge criteria and selected items from the assessment and treatment sections, did not meet the consensus threshold and were subsequently retained for re-evaluation in the second round.

3.2. Second Round Findings

Thirty-one of the 34 Round-1 participants completed Round-2 (retention 91.2%). Although Delphi studies have no universal minimum panel size, recent methodological work indicates that a sample of approximately 20–30 experts is generally sufficient to achieve stable, replicable results; our Round-2 panel of 31 therefore exceeds this benchmark (Manyara et al., 2024).

Figure 2-4 presents the distribution of expert response items for all 106 items, showing the number of respondents who selected each response option ("Strongly agree," "Agree," "Disagree," "Strongly disagree"). These graphically display the extent of agreement and response patterns across the panel.

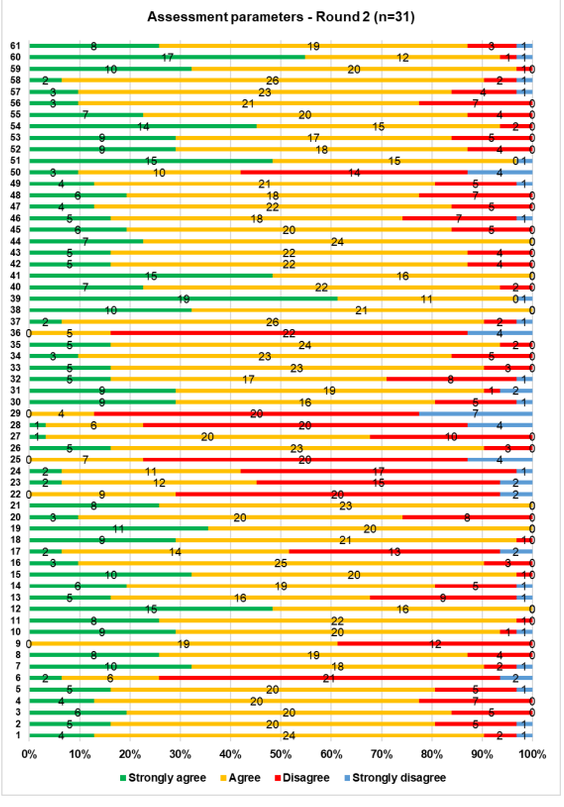

***Figure 2. Distribution** of expert responses for Assessment parameters in the second Delphi round.*

Item numbers in the figure match the questionnaire numbering provided in Additional File 1.

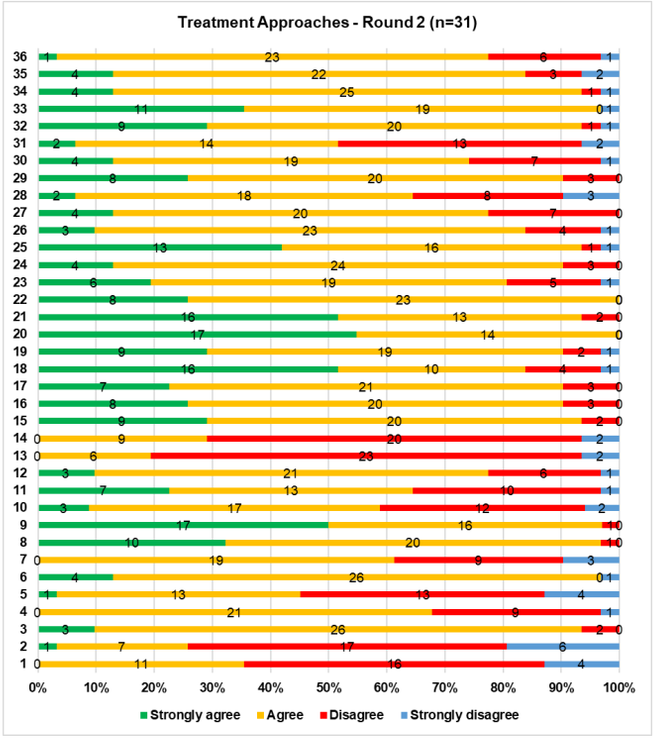

***Figure 3. Distribution** of expert responses for Treatment Approaches in the second Delphi round.*

Item numbers in the figure match the questionnaire numbering provided in Additional File 1.

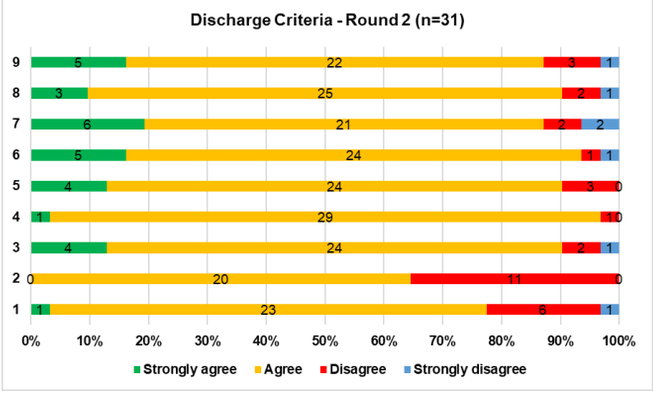

***Figure 4.** Distribution of expert responses for Discharge Criteria in the second Delphi round.*

Item numbers in the figure match the questionnaire numbering provided in Additional File 1.

All 42 items that did not meet the predefined consensus threshold of ≥75% agreement in the first round received structured feedback in the form of mean scores and agreement percentages, and expert commentary was specifically invited. However, all 106 items were re-evaluated in the second round to identify any potential changes in expert opinions following the presentation of group-level feedback.

The second round of the study led to a consensus being reached on 15 additional items. These items included 9 items from the assessment parameters domain, 4 from the treatment approaches (one of which replaced an already accepted item), and 2 from the discharge criteria domain.

A total of 76 out of 106 items (71.7%) reached the predetermined consensus threshold by the end of the second round. The results per domain were as follows: assessment parameters had 44 out of 61 items meeting the threshold (Table 2), treatment approaches had 24 out of 36 items meeting the threshold (Table 3), and discharge criteria had 8 out of 9 items meeting the threshold (Table 4). These consensus statements will be used to develop a clinical guideline for the assessment, treatment, and discharge criteria for individuals with PFPS.

Several items received high levels of agreement in the second round. The assessment parameters items "Activities that aggravate pain", "Ascending and descending stairs", "Use demographic information", "Assess the location of pain", "Assess muscle strength", and "Daily living activities difficulty in PFPS diagnosis" had consensus levels ranging from 96.7% to 100%. The items within the treatment approaches domain, which included "Use quadriceps strengthening", "Use open kinetic chain exercises", "Use electrotherapy agents in the clinic", "Use patellar mobilization", and "Use kinesiotape", achieved high consensus levels (≥96.8%). The indicator "pain-free jumping" was the strongest indicator of functional recovery according to the Discharge Criteria, with a consensus level of 96.8%.

4. DISCUSSION

This study was designed with the Delphi method to determine the standards for selecting assessment and treatment approaches among physiotherapists and researchers working in the field of PFPS. It demonstrates the iterative transition from divergent expert opinions to consensus across two Delphi rounds.

In the first round of our study, we identified the activities that increase pain and the localization of pain as critical components in the PFPS diagnostic process. Other important diagnostic components included patellar provocation, the grind and tilt tests, questions about daily activities and activities that increase pain, pain localization, pain during the descent of stairs and slopes, running and jumping, demographic information, patient history, muscle strength, the Q angle, Rom values in the knee and hip joints, and muscle flexibility evaluations, and their importance in the PFPS evaluation was emphasized. In the second round, which we conducted to facilitate the transition from different opinions to a common view among experts, a high degree of consensus was reached, particularly on "activities that aggravate pain and the localization of pain, as well as stair climbing, demographic information, muscle strength, and the assessment of difficulties in daily living activities."

Although many factors have been suggested as potential causes of PFPS, a consensus has not yet been reached on its etiology (Callahan et al., 2025). The global prevalence of PFPS is estimated to reach 20–30% among young and physically active individuals and is approximately twice as common in women as in men (Xu et al., 2024). The main reason for sex differences in PFPS prevalence stems from biomechanical factors which include weaker hip abductors and external rotators and more femoral internal rotation and dynamic knee valgus (Szybist et al., 2025). Moreover, repetitive high-impact activities such as running, jumping, and squatting, combined with inadequate neuromuscular control and abrupt load variations, have been identified as major extrinsic factors contributing to PFPS development (Chamorro-Moriana et al., 2024). PFPS development results from a complex interaction between intrinsic and extrinsic factors. Therefore, its evaluation should adopt a complete evaluation system that considers not only structural parameters but also loading history, muscle performance, neuromuscular control, and functional capacity.

PFPS is primarily diagnosed on the basis of patient history and clinical evaluation because although imaging methods can detect patellar chondral lesions, this finding is not specific (Décary et al., 2018). Current evidence emphasizes that the patient-reported pain pattern and pain provocation during functional tests play a decisive role in clinical diagnosis. In particular, the presence of pain during squatting and stair descent has been shown to distinguish PFPS from other anterior knee pain syndromes with high sensitivity. The positive response to these tests reflects increased patellofemoral joint loading and symptom reproduction, representing level-1 evidence in guiding clinical decision-making (Mostafaee et al., 2024; Willy et al., 2019).

The current research demonstrates that using individual clinical tests fails to identify all factors which contribute to PFPS. The combination of functional provocation tests (such as squat and eccentric step and stair descent) with validated patient-reported outcome measures (including KOOS-PF and Kujala) provides better diagnostic precision and improved clinical decision-making.However, in our Delphi study, these self-reported tools achieved relatively low consensus, indicating that their clinical use may still be limited or less prioritized by physiotherapists in daily practice compared with functional performance-based assessments (Callahan et al., 2025; Chamorro-Moriana et al., 2024).

In the first round of our Delphi study, in which we examined the most frequently used current treatment approaches employed by physiotherapists and researchers working in the field of PFPS, a high level of consensus was reached regarding the treatment of PFPS, including cold packs; the use of electrotherapy agents; patellar mobilization; dry needling; stretching exercises for the TFL, Gastrosoleus and hamstrings muscles; strength training for the quadriceps, gluteal and core muscles; proprioception training; the use of kinesiotape; exercise for the arch of the foot; and the use of foot orthoses. A high level of consensus was reached in the second round, particularly regarding the 'use of Kinesiotape', 'Electrotherapy Agents', 'Patellar Mobilization', 'Quadriceps Strengthening', 'Open Kinetic Chain Exercises' and 'Exercise training with Resistance Bands'. However, despite reaching a consensus in the first round of dry needling, no consensus was reached in the second round. A 2025 systematic review to determine the effectiveness of dry needling in the treatment of PFPS revealed that dry needling therapy, when added to an exercise program, provided a small improvement in physical function but did not show a significant advantage over other trigger point treatments (Sun & Liu, 2025). However, more high-quality studies are needed for definitive conclusions.

In the treatment of PFPS, clinicians and researchers have focused primarily on reducing pain and restoring function. Treatment approaches such as ice packs, taping techniques, the use of nonsteroidal anti-inflammatory drugs (NSAIDs), mobilization, strengthening exercises for the quadriceps and hip muscles, and activity modification are generally used to reduce pain (Gaitonde et al., 2019). The Delphi study results showed complete agreement about these established treatment methods because they remain essential initial approaches for PFPS care.

Strengthening the quadriceps and the gluteus medius and maximus muscles, which serve as the primary stabilizers of the hip, is frequently recommended because it contributes to both pain reduction and functional improvement (Collins et al., 2018; Marra, 2020). Exercise programs that target both hip and knee muscle groups have demonstrated short-, medium-, and long-term effectiveness in reducing pain, supported by high-level evidence (Willy et al., 2019). In alignment with these findings, our Delphi results indicated that muscle strengthening, open kinetic chain exercises, and various resistance training approaches were perceived by experts as highly effective strategies for PFPS rehabilitation.

Electrotherapy and KT are commonly used adjunct modalities in PFPS management. The research by Zheng et al. (2025) analyzed neuromuscular electrical stimulation (NMES) treatment against exercise-only therapy which produced small improvements in pain and function and moderate-to-small increases in quadriceps strength (Zheng et al., 2025). The wide range of treatment approaches and insufficient research quality indicates that NMES functions best as a supplementary treatment instead of a main treatment for PFPS. The majority of experts in our Delphi study strongly endorsed electrotherapy because they view it as an effective method to activate muscles and improve motor control for specific PFPS patients. The application of KT serves multiple purposes which include strengthening muscles and enhancing knee performance and pain relief. Research evidence indicates that KT delivers brief pain relief but fails to generate meaningful long-term functional advantages when compared to exercise therapy or electrotherapy (Luo et al., 2024; Miller et al., 2013). The two modalities function as additional therapeutic approaches which help patients perform exercise-based rehabilitation and manage short-term

symptoms but they should not be used independently as primary treatments.

Foot orthoses are commonly used adjuncts in the management of PFPS to support symptom control. Recent systematic reviews have shown that orthoses can provide short-term pain relief but do not outperform exercise-based interventions in the long term (Callahan et al., 2025; Chen et al., 2022). In our Delphi study, low consensus was reached regarding the use of foot orthoses, suggesting that their clinical effectiveness may be limited to specific subgroups—particularly individuals with excessive pronation or altered foot biomechanics.

Pain assessment remains one of the most evidence-based criteria for evaluating treatment effectiveness and determining discharge readiness in patients with PFPS. Compared to other pain scales, Visual analog scale (VAS) offers advantages due to its simplicity and minimal sensitivity to linguistic or cultural differences. When establishing discharge criteria, patients are typically asked to evaluate whether they can perform demanding functional tasks (such as running, jumping, or stair climbing) without pain; if minimal symptoms persist, these are quantitatively rated using a VAS score (Crossley et al., 2004; Richard W. Willy et al., 2019). In our Delphi study, high consensus in Round 1 was achieved for criteria including pain ≤2 on the VAS during activity or sport, pain-free performance during running, jumping, and stair descent, and absence of pain during diagnostic clinical tests. In Round 2, experts also agreed that muscle strength should be comparable to the contralateral limb and that no night pain (VAS ≤2) should be present.

The research contains multiple restrictions that affect its findings. The lack of standardized methodological approaches for Delphi studies creates challenges when researchers attempt to compare findings from studies with similar research objectives. The participants demonstrated expertise in PFPS assessment and treatment yet their clinical experience and exposure levels differed from one another. The researchers omitted collecting specific workload data about weekly patient numbers because of response burden concerns which restricted their ability to measure participant heterogeneity and potentially reduced study generalizability. The extensive nature of the questionnaire might have caused participants to lose interest throughout the study duration. The study followed established Delphi standards while participant diversity led to an equitable consensus among participants.

The four-point scale with forced-choice options helped participants achieve directional agreement but the lack of a neutral choice might have forced some participants to select an option. The discharge criteria developed for adult PFPS patients do not directly translate to older adults or competitive athletes or people with obesity or multiple health conditions. Future work should develop and validate subgroup-specific discharge thresholds using stratified or multi-stakeholder Delphi panels and prospective validation.

5. CONCLUSION

The diversity and complexity of the etiology of PFPS is one of the clinical challenges for healthcare professionals in regard to determining diagnoses and treatment approaches. For the treatment of PFPS, the patient's specific etiological criteria should be determined, and the treatment protocol should be prepared individually for each patient. The current literature lacks a universal PFPS patient profile; therefore, there is no consensus on a defined diagnostic or treatment protocol. This study provides a foundational expert consensus that may serve as a basis for future clinical guidelines addressing PFPS diagnosis and treatment. However, further research is needed to establish reliable diagnostic and treatment guidelines for patients with PFPS.

Declaration

Ethics approval and consent to participate: Ethical approval was obtained from the Ethics Committee of the Faculty of Health Sciences, Marmara University (Approval No: 29.12.2022/160). Written informed consent was obtained from all participants prior to enrollment.

Consent for publication: Not applicable

Availability of data and materials: The datasets generated and analyzed during the current study are provided as supplementary files and are available upon request from the corresponding author.

Competing interests: The authors declare that they have no conflicts of interest.

Authors' contributions: JHB designed the study and created the questionnaire while performing data analysis and maintaining the study's overall progress. GG participated in designing the study and was involved in preparing the manuscript. MC wrote the manuscript while being in charge of sending emails to participants for study participation and follow-up. YÖ helped create study questions and wrote parts of the manuscript. TKÇ participated in designing the study and made essential editorial changes to the manuscript. ZS supervised the protocol development process and provided expert guidance throughout. All the authors reviewed and approved the final version of this protocol.

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REFERENCES

[1] Callahan, E. A., Chin, K. E., & Chu, S. K. (2025). Current Evidence of Evaluation and Management of the Athlete with Patellofemoral Pain Syndrome. Current Physical Medicine and Rehabilitation Reports, 13(1). https://doi.org/10.1007/s40141.025.00502-9

[2] Chamorro-Moriana, G., Espuny-Ruiz, F., Ridao-Fernández, C., & Magni, E. (2024). Clinical value of questionnaires & physical tests for patellofemoral pain: Validity, reliability and predictive capacity. PLoS One, 19(4), e0302215. https://doi.org/10.1371/journal.pone.0302215

[3] Chen, Z., Wu, J., Wang, X., & Ren, Z. (2022). The effect of foot orthoses for patients with patellofemoral pain syndrome: A systematic review and meta-analysis. Heliyon, 8(6), e09656. https://doi.org/10.1016/j.heliyon.2022.e09656

[4] Chyung, S. Y. Y., Roberts, K., Swanson, I., & Hankinson, A. (2017). Evidence-Based Survey Design: The Use of a Midpoint on the Likert Scale. Performance Improvement, 56(10), 15-23. https://doi.org/10.1002/pfi.21727

[5] Collins, N. J., Barton, C. J., van Middelkoop, M., Callaghan, M. J., Rathleff, M. S., Vicenzino, B. T., Davis, I. S., Powers, C. M., Macri, E. M., Hart, H. F., de Oliveira Silva, D., & Crossley, K. M. (2018). 2018 Consensus statement on exercise therapy and physical interventions (orthoses, taping and manual therapy) to treat patellofemoral pain: recommendations from the 5th International Patellofemoral Pain Research Retreat, Gold Coast, Australia, 2017. British Journal of Sports Medicine, 52(18), 1170-1178. https://doi.org/10.1136/bjsports-2018-099397

[6] Collins, N. J., Bierma-Zeinstra, S. M., Crossley, K. M., van Linschoten, R. L., Vicenzino, B., & van Middelkoop, M. (2013). Prognostic factors for patellofemoral pain: a multicentre observational analysis. British Journal of Sports Medicine, 47(4), 227-233. https://doi.org/10.1136/bjsports-2012-091696

[7] Collins, N. J., Crossley, K. M., Darnell, R., & Vicenzino, B. (2010). Predictors of short and long term outcome in patellofemoral pain syndrome: a prospective longitudinal study. BMC Musculoskelet Disorders, 11, 11. https://doi.org/10.1186/1471-2474-11-11

[8] Crossley, K. M., Bennell, K. L., Cowan, S. M., & Green, S. (2004). Analysis of outcome measures for persons with patellofemoral pain: which are reliable and valid? Archives of Physical Medicine and Rehabilitation, 85(5), 815-822. https://doi.org/10.1016/s0003-9993(03)00613-0

[9] Crossley, K. M., van Middelkoop, M., Callaghan, M. J., Collins, N. J., Rathleff, M. S., & Barton, C. J. (2016). 2016 Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester. Part 2: recommended physical interventions (exercise, taping, bracing, foot orthoses and combined interventions). British Journal of Sports Medicine, 50(14), 844-852. https://doi.org/10.1136/bjsports-2016-096268

[10] Dalkey, N., & Helmer, O. (1963). An experimental application of the Delphi method to the use of experts. Management Science, 9(3), 458-467.

[11] Décary, S., Frémont, P., Pelletier, B., Fallaha, M., Belzile, S., Martel-Pelletier, J., Pelletier, J. P., Feldman, D., Sylvestre, M. P., Vendittoli, P. A., & Desmeules, F. (2018). Validity of Combining History Elements and Physical Examination Tests to Diagnose Patellofemoral Pain. Archives of Physical Medicine and Rehabilitation, 99(4), 607-614.e601. https://doi.org/10.1016/j.apmr.2017.10.014

[12] Dey, P., Callaghan, M., Cook, N., Sephton, R., Sutton, C., Hough, E., James, J., Saqib, R., & Selfe, J. (2016). A questionnaire to identify patellofemoral pain in the community: an exploration of measurement properties. BMC Musculoskelet Disorders, 17, 237. https://doi.org/10.1186/s12891.016.1097-5

[13] Diamond, I. R., Grant, R. C., Feldman, B. M., Pencharz, P. B., Ling, S. C., Moore, A. M., & Wales, P. W. (2014). Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. Journal of Clinical Epidemiology, 67(4), 401-409.

[14] Gaitonde, D. Y., Ericksen, A., & Robbins, R. C. (2019). Patellofemoral Pain Syndrome. American Family Physician, 99(2), 88-94.

[15] Lange, T., Kopkow, C., Lützner, J., Günther, K.-P., Gravius, S., Scharf, H.-P., Stöve, J., Wagner, R., & Schmitt, J. (2020). Comparison of different rating scales for the use in Delphi studies: different scales lead to different consensus and show different test-retest reliability. BMC Medical Research Methodology, 20(1). https://doi.org/10.1186/s12874.020.0912-8

[16] Lankhorst, N. E., van Middelkoop, M., Crossley, K. M., Bierma-Zeinstra, S. M., Oei, E. H., Vicenzino, B., & Collins, N. J. (2016). Factors that predict a poor outcome 5-8 years after the diagnosis of patellofemoral pain: a multicentre observational analysis. British Journal of Sports Medicine, 50(14), 881-886. https://doi.org/10.1136/bjsports-2015-094664

[17] Loughlin, K. G., & Moore, L. F. (1979). Using Delphi to achieve congruent objectives and activities in a pediatrics department. Academic Medicine, 54(2), 101-106.

[18] Luo, Y., Chen, X., Shen, X., Chen, L., & Gong, H. (2024). Effectiveness of Kinesio tape in the treatment of patients with patellofemoral pain syndrome: A systematic review and meta-analysis. Medicine (Baltimore), 103(23), e38438. https://doi.org/10.1097/md.000.000.0000038438

[19] Manyara, A. M., Purvis, A., Ciani, O., Collins, G. S., & Taylor, R. S. (2024). Sample size in multistakeholder Delphi surveys: at what minimum sample size do replicability of results stabilize? Journal of Clinical Epidemiology, 174, 111485. https://doi.org/10.1016/j.jclinepi.2024.111485

[20] Marra, J. (2020). Patellofemoral Pain: Guidelines from the American Physical Therapy Association. American Family Physician, 102, 442-443. https://doi.org/10.2519/jospt.2019.0302

[21] McKenna, H. P. (1994). The Delphi technique: a worthwhile research approach for nursing? J Adv Nurs, 19(6), 1221-1225. https://doi.org/10.1111/j.1365-2648.1994.tb01207.x

[22] Meshkat, B., Cowman, S., Gethin, G., Ryan, K., Wiley, M., Brick, A., Clarke, E., & Mulligan, E. (2014). Using an e-Delphi technique in achieving consensus across disciplines for developing best practice in day surgery in Ireland. Journal of Hospital Administration, 3(4), 1-8.

[23] https://doi.org/10.5430/jha.v3n4p1.

[24] Miller, J., Westrick, R., Diebal, A., Marks, C., & Gerber, J. P. (2013). Immediate effects of lumbopelvic manipulation and lateral gluteal kinesio taping on unilateral patellofemoral pain syndrome: a pilot study. Sports Health, 5(3), 214-219. https://doi.org/10.1177/194.173.8112473561

[25] Mostafaee, N., Pashaei-Marandi, M., Negahban, H., Pirayeh, N., Saki Malehi, A., & Ebrahimzadeh, M. H. (2024). Examining the diagnostic accuracy of common physical examination and functional tests in the diagnosis of patellofemoral pain syndrome among patients with anterior knee pain. Physiotheraphy Theory and Practice, 40(4), 843-855. https://doi.org/10.1080/09593.985.2022.2158053

[26] Neal, B. S., Lack, S. D., Bartholomew, C., & Morrissey, D. (2024). Best practice guide for patellofemoral pain based on synthesis of a systematic review, the patient voice and expert clinical

reasoning. British Journal of Sports Medicine, 58(24), 1486-1495. https://doi.org/10.1136/bjsports-2024-108110

[27] Rathleff, M. S., Rathleff, C. R., Crossley, K. M., & Barton, C. J. (2014). Is hip strength a risk factor for patellofemoral pain? A systematic review and meta-analysis. British Journal of Sports Medicine, 48(14), 1088. https://doi.org/10.1136/bjsports-2013-093305

[28] Rowe, G., & Wright, G. (1999). The Delphi technique as a forecasting tool: issues and analysis. International Journal of Forecasting, 15(4), 353-375.

[29] Smith, B. E., Selfe, J., Thacker, D., Hendrick, P., Bateman, M., Moffatt, F., Rathleff, M. S., Smith, T. O., & Logan, P. (2018). Incidence and prevalence of patellofemoral pain: A systematic review and meta-analysis. PLoS One, 13(1), e0190892. https://doi.org/10.1371/journal.pone.0190892

[30] Spranger, J., Homberg, A., Sonnberger, M., & Niederberger, M. (2022). Reporting guidelines for Delphi techniques in health sciences: A methodological review. Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen, 172, 1-11. https://doi.org/10.1016/j.zefq.2022.04.025

[31] Staniszewska, A., Gaba, K., Patterson, B., Wilson, S., Bell, R., Bicknell, C., Brooks, M., Callaway, M., Goode, S., Grier, S., Hobson, A., Mouton, R., Neequaye, S., Owens, G., Rajakaruna, C., Redfern, E., Tsang, G., & Hinchliffe, R. (2024). Consensus statement on the interhospital transfer of patients with acute aortic syndrome: TRAVERSING Delphi study. Emergency Medicine Journal, 41(3), 153-161. https://doi.org/10.1136/emermed-2023-213362

[32] Stewart, D., Gibson-Smith, K., MacLure, K., Mair, A., Alonso, A., Codina, C., Cittadini, A., Fernandez-Llimos, F., Fleming, G., & Gennimata, D. (2017). A modified Delphi study to determine the level of consensus across the European Union on the structures, processes and desired outcomes of the management of polypharmacy in older people. PLoS One, 12(11), e0188348.

[33] Sun, Z., & Liu, R. (2025). Therapeutic effects of dry needling for patellofemoral pain syndrome: a systematic review and meta-analysis. Complementary Therapies in Clinical Practice, 59, 101938. https://doi.org/10.1016/j.ctcp.2025.101938

[34] Szybist, S., Houser, A., Corletto, J., & Maloy, W. (2025). Patellofemoral Biomechanics Considerations: Analysis of Factors Contributing to Patellofemoral Pain. Current Sports Medicine Reports, 24(9), 275-280. https://doi.org/10.1249/jsr.000.000.0000001284

[35] Taylor, E. (2020). We Agree, Don't We? The Delphi Method for Health Environments Research. Health Environments Research & Design Journal, 13(1), 11-23. https://doi.org/10.1177/193.758.6719887709

[36] van Middelkoop, M., van Linschoten, R., Berger, M. Y., Koes, B. W., & Bierma-Zeinstra, S. M. (2008). Knee complaints seen in general practice: active sport participants versus non-sport participants. BMC Musculoskelet Disorders, 9, 36. https://doi.org/10.1186/1471-2474-9-36

[37] Veraar, C., Hasler, P., & Schirmer, M. (2018). A multidisciplinary Delphi consensus-based checklist to define clinical documentation tools for both routine and research purposes. Health services research and managerial epidemiology, 5, 233.339.2817754161.

[38] Wallis, J. A., Roddy, L., Bottrell, J., Parslow, S., & Taylor, N. F. (2021). A Systematic Review of Clinical Practice Guidelines for Physical Therapist Management of Patellofemoral Pain. Physical Therapy, 101(3). https://doi.org/10.1093/ptj/pzab021

[39] Williams, P. L., & Webb, C. (1994). Clinical supervision skills: a Delphi and critical incident technique study. Medical Teacher, 16(2-3), 139-157.

[40] Willy, R. W., Hoglund, L. T., Barton, C. J., Bolgla, L. A., Scalzitti, D. A., Logerstedt, D. S., Lynch, A. D., Snyder-Mackler, L., & McDonough, C. M. (2019). Patellofemoral Pain. Journal of Orthopaedic & Sports Physical Therapy, 49(9), Cpg1-cpg95. https://doi.org/10.2519/jospt.2019.0302

[41] Willy, R. W., Hoglund, L. T., Barton, C. J., Bolgla, L. A., Scalzitti, D. A., Logerstedt, D. S., Lynch, A. D., Snyder-Mackler, L., & McDonough, C. M. (2019). Patellofemoral Pain. Journal of Orthopaedic & Sports Physical Therapy, 49(9), CPG1-CPG95. https://doi.org/10.2519/jospt.2019.0302

[42] Witvrouw, E., Crossley, K., Davis, I., McConnell, J., & Powers, C. M. (2014). The 3rd International Patellofemoral Research Retreat: an international expert consensus meeting to improve the scientific understanding and clinical management of patellofemoral pain. British Journal of Sports Medicine, 48(6), 408. https://doi.org/10.1136/bjsports-2014-093437

[43] Xu, J., Cai, Z., Chen, M., Wang, X., Luo, X., & Wang, Y. (2024). Global research trends and hotspots in patellofemoral pain syndrome from 2000 to 2023: a bibliometric and visualization study. Frontiers in Medicine (Lausanne), 11, 1370258. https://doi.org/10.3389/fmed.2024.137.0258

[44] Zheng, J., Wei, Z., Zuo, H., Wang, K., Lin, X., & Chen, J. (2025). The effect of adding neuromuscular electrical stimulation to exercise therapy on patellofemoral pain: A systematic review and meta-analysis. PLoS One, 20(6), e0326785. https://doi.org/10.1371/journal.pone.0326785

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