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Top 50 Cited Articles on Patellar Tendinopathy: A Bibliometric Study

Patellar Tendinopati Hakkında En Çok Atıf Alan 50 Makale: Bibliyometrik Çalışma

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ABSTRACT Objective: Patellar tendinopathy is a syndrome frequently reported in sports that involve jumping. It is a debilitating condition that can result in absence or retirement from sports participation. The aim of this study is to analyze the 50 most cited articles on patellar tendinopathy and jumper's knee to determine the current trends and to guide future studies in this topic. **Material and Methods:** A search was conducted on the Web of Science database using the keywords "patellar tendinopathy" and "jumper's knee". The reviewers recorded the title of the articles, total number of authors and authors' names, year of publication, number of citations and citation index, publishing journal, Q category, h-index, impact factor, authors' countries. **Results:** While 38 of the 50 articles were clinical studies, remaining included reviews (n=11) and a meta-analysis. Almost half of the clinical studies (n=18) investigated the efficacy of the methods used in the treatment of the disease. Among these, 15 used the Victorian Institute of Sports Assessment (VISA) scale as an objective assessment tool. As for the type of articles, case-control studies were prominent (n=16). A moderate correlation was detected between the citation index and the total citations. **Conclusion:** Future studies can achieve a higher reliability by using objective questionnaires such as VISA to assess treatment efficacy and by using imaging methods such as ultrasonography to confirm the diagnosis of the disease. Funding allocation by goverenments is needed for the development of sport sciences.

Keywords: Patellar tendinopathy; physical therapy and rehabilitation; bibliometric analysis

ÖZET Amaç: Patellar tendinopati, zıplama içeren sporlarda sıklıkla bildirilmiş olup, spor aktivitelerinden uzak kalmaya veya kariyer bitimine neden olabilir. Bu çalışmanın amacı, "patellar tendinopati" ve "jumper's knee" hakkında en çok atıf alan 50 makaleyi analiz ederek, bu konudaki güncel ilgi alanlarını ortaya koymak ve gelecekteki çalışmalara yol göstermektir. **Gereç ve Yöntemler:** Web of Science veri tabanı kullanılarak, "patellar tendinopathy" ve "jumper's knee" anahtar kelimeleri ile makaleler araştırıldı. Makalelerin ismi, toplam yazar sayısı ve yazarların isimleri (sorumlu yazar ve ilk isim olan yazar), makalenin yayımlandığı yıl, atıf sayısı ve atıf indeksi, yayınlayan deriginin adı ve Q kategorisi, H-indeksi, impact faktörü, yazarların ülkeleri kaydedildi. **Bulgular:** Elli makalenin 38'i klinik çalışmalardan oluşurken, 11'i derleme ve 1'i metaanaliz çalışmasıydı. Klinik makalelerin yarıya yakını (n=18) tedavi metotlarının etkinliğini değerlendirmekteydi. Tedavi metotlarının değerlendirildiği çalışmaların 15'inde objektif bir değerlendirme skalası olan "Victorian Institute of Sports Assessment (VISA)" skalası kullanılmıştır. Makalelerin tiplerine bakıldığında en büyük kesimi vaka-kontrol çalışmaları oluşturmaktaydı (n=16). Atıf sayısı ile atıf indeks sayısı arasında orta dereceli korelasyon tespit edildi. **Sonuç:** Gelecekteki çalışmaları dizayn ederken tedavi etkinliğini değerlendirmek için VISA gibi objektif anketlere başvurulması ve hastalığın tanısının ultrasonografi gibi görüntüleme yöntemleriyle doğrulanması çalışmaların güvenilirliğini artırabilir. Hükûmetler tarafından spor bilimlerinin gelişimi için kaynak ayrılmasına ihtiyaç vardır.

Anahtar Kelimeler: Patellar tendinopati; fizik tedavi ve rehabilitasyon; bibliyometrik analiz

Patellar tendinopathy is a syndrome frequently reported in jumping sports involving movement of the extensor mechanism of the knee. Its prevalence among elite athletes in sports such as volleyball and basketball approaches 50 percent.[1] The most common underlying pathology in patellar tendinopathy is degenerative tendinosis, affecting mostly the proximal part of the tendon.[2] Although the pathogenesis of this condition is not clearly understood, various intrinsic and extrinsic factors may be involved in its etiology.[3]

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Diagnosis is based on medical history, physical examination and imaging methods. Treatment options include relative rest, physical therapy and surgery. Over the years, with the development of technology and the emergence of new treatment modalities, an increasing number of articles have investigated patellar tendinopathy. There are bibliometric analyses of studies on rotator cuff tendon, osteoarthritis rehabilitation and patellar instability, but to our knowledge, there is no bibliometric analysis of research on patellar tendinopathy.[4-6]

Bibliometric analysis is used to analyze large volumes of data on a particular subject using quantitative and qualitative methods to reveal emerging trends and scientific performance on that subject. The ease of access to information provided by the emergence of scientific databases such as Scopus (Elsevier, Amsterdam, Netherlands) and Web of Science (Clarivate Analytics, Philadelphia, USA) has led to popularization of bibliometric studies in recent years. This method can reveal areas that have remained out of focus in previous studies and can guide academics in their future studies.

One of the methods used to determine the quality of an article is to analyze the number of citations it has received. It is not the only criterion, but given that authors cite the works they find useful, frequently cited publications may be assumed to have been more useful than papers which are less frequently cited.[7]

Citation analysis can identify leading authors, countries, institutes and journals in a particular field. The aim of this article is to perform a bibliometric analysis of the 50 most cited articles on patellar tendinopathy that were published between 1980 and 2022 in order to reveal new developments and trends in this field, to guide future studies and to improve our understanding of this high-morbidity disease.

MATERIAL AND METHODS

On April 15, 2023, a search was conducted on the Web of Science database using the keywords 'patellar tendinopathy' and "jumper's knee" to scan the articles on these topics published between 1980 and 2022. The results were sorted based on the number of citations, with the most cited article appearing at the top. Since the data in this study were derived from previous studies, ethics committee approval was waived.

ARTICLE SELECTION

The 50 most cited articles on patellar tendinopathy were identified. Abstracts and/or full texts of the articles were reviewed by two independent reviewers (FHT, FB). Of these articles, 46 exclusively dealt with patellar tendinopathy, 3 of them was about patellar and Achilles tendinopathy, and one dealt with lower-extremity tendinopathy (greater trochanteric pain syndrome, patellar tendinopathy, Achilles tendinopathy).

DATA EXTRACTION

To conduct the bibliometric analysis of the articles, the reviewers recorded the title of the articles, total number of authors and authors' names (corresponding author and first named author), year of publication, number of citations and citation index, name of the publishing journal and Q category, h-index, impact factor, authors' countries, types of articles, sample sizes of the articles, and funding sources. When authors were from different countries, the country of the corresponding author was taken as the country of publication. The citation index was calculated as the ratio of the total number of citations received by the article to the number of years since the article was published.

STATISTICAL ANALYSIS

Statistical analysis was conducted using IBM SPSS Statistics v24.0 statistical software (Armonk, NY, USA). Variables were analyzed for the normality of distribution using the Shapiro-Wilk test. Descriptive statistics were analyzed using mean±standard deviation and median values (minimum-maximum) for quantitative variables, and using percentage and frequency for categorical variables. Correlation between non-normally distributed variables was analyzed using Spearman's rank correlation coefficient. Correlation between variables was considered to be strong for $r \geq 0.60$, moderate for r between 0.30 and 0.60, and weak for $r \leq 0.30$. Statistical significance was set at $p<0.05$.

RESULTS

A search was conducted on the Web of Science database using the keywords "patellar tendinopathy" or "jumper's knee" to scan articles published between 1980 and 2022. The 50 most cited articles were ranked by number of citations. The oldest article was from 1997, while the most recent articles were from 2015. The total number of citations received by the articles ranged from 517 to 60. The articles had received a total of 5,569 citations, with an average citation count of 111.38. The most cited article was "Studies of surgical outcome after patellar tendinopathy: clinical significance of methodological deficiencies and guidelines for future studies" by Coleman et al. published in 2000. This article also had the highest citation index with 23.5. The mean citation index was 8.24. The most prolific year was 2007 (n=10). All articles were written in English. The total number of citations and articles published by year is presented in Figure 1.[8-57]

Authorship analysis of the first 50 articles showed that the author with the highest total number of citations was Cook with a total of 1,535 citations and 18 articles. Again, the author with the highest number of articles was Cook with 18 articles (Figure 2). Moderate correlation was detected between the citation index and the total citations ($p<0.05$). General information about the articles in the T50, authors of the articles and the number of citations is presented in Table 1.

Looking at the top contributing institutions, La Trobe University ranked first with 13 papers, followed by the Australian Institute of Sport with 9 papers. Institutional affiliation of the publications in the T50 is presented in Figure 3.

Analysis by journal showed that the journal with highest number of articles was *the British Journal of Sports Medicine* with 14 articles and 1,445 citations; it also had the highest impact factor. *The American Journal of Sports Medicine* ranked second with 13 articles and 1,295 citations. More than half of the first 50 articles were published in these 2 journals. All but one of the journals were in the Q1 category. The journal *Stem Cells Information* magazine was in the Q2 category. The journals in the T50, their h-indexes, impact factors, and Q categories are presented in Table 2.

Analysis of the articles in the T50 by year of publication showed that the most prolific year was 2007, with a total of 10 articles from this year in the T50. The year with the highest number of total citations was 2020 with 551 citations. As for the type of articles in the T50, 11 were reviews, 1 was meta-analysis, and 38 were clinical studies. Clinical studies included 11 randomized controlled trials (RCTs), 11 prospective studies, and 16 case-control studies. Seventeen of the 38 clinical trials supported the diagnosis of the disease by using imaging modalities. Analysis by subject showed that almost half of the clinical studies (n=18) investigated the efficacy of the methods used in the treatment of the disease, 4 were related to radiological imaging, and the rest included anthropometric (n=6) and pathological (n=10) studies. Of the 18 clinical studies which investigated the efficacy of the treatment methods, 15 used the Vic-

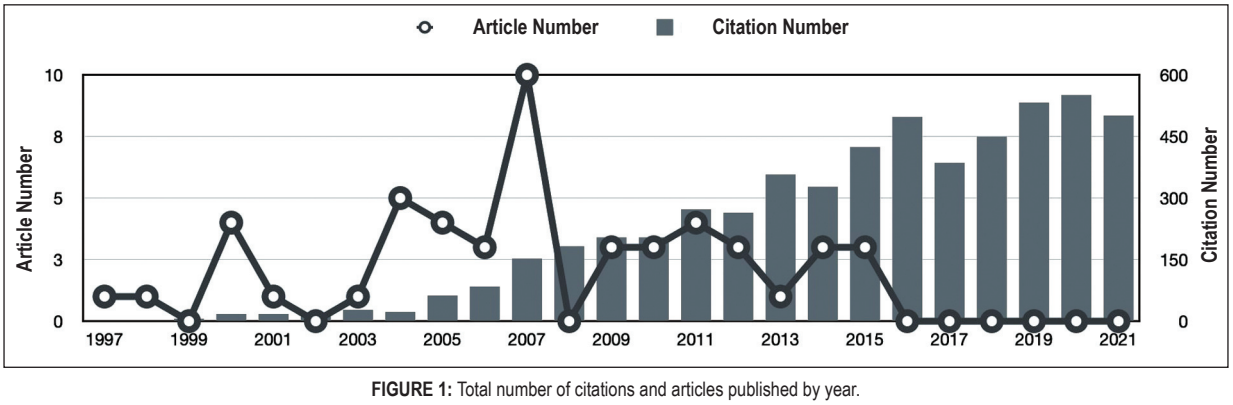

FIGURE 1: Total number of citations and articles published by year.

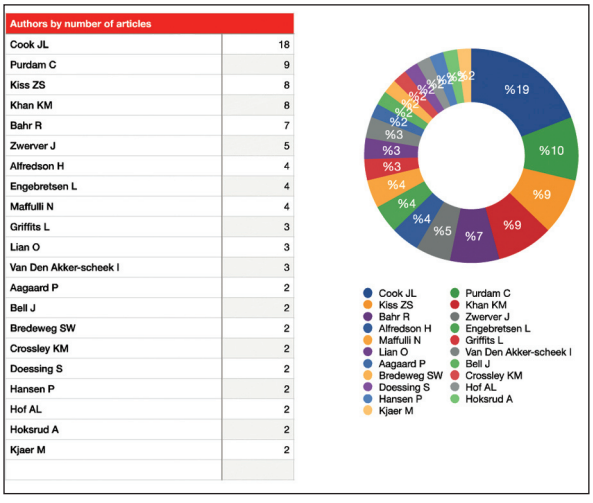

FIGURE 2: Total number of articles by author.

torian Institute of Sports Assessment (VISA) scale as an objective assessment tool, 2 used the visual analogue scale (VAS), and 1 used subjective methods.

As for the countries of origin of the articles, the most productive countries were found to be Australia with 19 articles and Canada with 9 articles. These countries were followed by Sweden with 8 articles and Norway with 7 articles. The countries of origin of the articles is presented in Figure 4. In terms of publishers, Sage and BMJ Publishing Group were the leading publishers with 13 and 11 articles, respectively. Nineteen out of the 50 articles had received funding support.

DISCUSSION

Patellar tendinopathy is an overuse pathology caused by strenuous activities and is one of the most common tendinopathies seen in clinical practice. Diagnosis is based on activity-related anterior knee pain, physical examination, ultrasound and magnetic resonance imaging (MRI).[58] Objective tests such as VISA scale are favored over subjective tests for monitoring disease or treatment.[59] Although there are bibliometric analyses of research on various types of tendinopathies, to our knowledge, there is no bibliometric study on patellar tendinopathy.[60]

Clinical evaluation and examination are often sufficient for the diagnosis of patellar tendinopathy. Diagnosis can be established based on anterior knee pain at the distal pole of the patella that occurs with activity, and pain at the proximal patellar tendon on palpation and symptoms emerging with the decline squat test.[61] Of all the articles in the T50, only four were related to radiographic imaging of the disease representing low interest in the radiologic diagnosis of the disease. Radiographic imaging is occasionally used to exclude other causes of anterior knee pain such as patellar chondromalacia and to confirm diagnosis when clinical signs and symptoms are equivocal. MRI and ultrasound are imaging methods with reasonable accuracy that may help making the diagnosis. A prospective study by Warden et al. showed that gray-scale ultrasonography had higher accuracy in the diagnosis of patellar tendinopathy compared to MRI (83% vs. 70%) and attributed this to the superiority of gray-scale ultrasound in differentiating symptomatic participants.[28] Indicators of tendinopathy used in that study were hypoechoic areas or increased fusiform thickness in the patellar tendon on gray scale ultrasonography, and increased signal in proton density-weighted sequences and anteroposterior thickness of the patellar tendon on MRI.[62] Color Doppler ultrasound was used to investigate vascularization of the tendon in order to identify neovascularization and it was found to be highly successful in differentiating asymptomatic participants (94% specificity). In conclusion, the authors stated that ultrasonography, combined with Doppler, can be used as a diagnostic tool with high accuracy in the diagnosis of patellar tendinopathy.

Conservative treatment is the first line of defense in patellar tendinopathy.[63] Four of the top five articles in the T50 were about non-surgical treatment of patellar tendinopathy and three of them investigated exercise therapies, which is consistent with the conservative approach that is currently the dominant treatment modality for this disease. The first line of treatment in patellar tendinopathies varies from clinician to clinician and there is still no consensus on this issue. Although patellar tendinopathy is not mainly characterized by inflammation, corticosteroid injections may be used in treatment.[64] Furthermore, clinicians don't have a clear idea of which exercise therapies to choose. In the second most cited article, "Corticosteroid injections, eccentric decline squat

TABLE 1: General information related to the top 50 cited articles (sorted by total citations).

Title	Authors	Source title	Puplication year	Total citations	Citation index	Type of articles	Imaging
Studies of surgical outcome after patellar tendinopathy: clinical significance of methodological deficiencies and guidelines for future studies	Coleman BD, Khan KM, Maffulli N, Cook JL, Wark JD	Scandinavian Journal of Medicine & Science in Sports	2000	517	23.5	Review	
Corticosteroid injections, eccentric decline squat training and heavy slow resistance training in patellar tendinopathy	Kongsgaard M, Kovanen V, Aagaard P, Doessing S, Hansen P, Laursen AH, Kaldau NC, Kjaer M, Magnusson SP	Scandinavian Journal of Medicine & Science in Sports	2009	224	17.23	RCT	+
Achilles and patellar tendinopathy loading programmes a systematic review comparing clinical outcomes and identifying potential mechanisms for effectiveness	Malliaras P, Barton CJ, Reeves ND, Langberg H	Sports Medicine	2013	198	22	Review	
Use of platelet-rich plasma for the treatment of refractory jumper's knee	Filardo G, Kon E, Della Villa S, Vincentelli F, Fornasari PM, Marcacci M	International Orthopaedics	2010	172	14.33	PRO	-
Eccentric decline squat protocol offers superior results at 12 months compared with traditional eccentric protocol for patellar tendinopathy in volleyball players	Young MA, Cook JL, Purdam CR, Kiss ZS, Alfredson H	British Journal of Sports Medicine	2005	164	9.65	RCT	+
Platelet-rich plasma as a treatment for patellar tendinopathy a double-blind, randomized controlled trial	Dragoo Jason L, Wasterlain Amy S, Braun Hillary J, Nead Kevin T	American Journal of Sports Medicine	2014	161	20.13	RCT	+
A pilot study of the eccentric decline squat in the management of painful chronic patellar tendinopathy	Purdam CR, Johnsson P, Alfredson H, Lorentzon R, Cook JL, Khan KM	British Journal of Sports Medicine	2004	145	8.06	PRO	+
Patellar tendinopathy in athletes - Current diagnostic and therapeutic recommendations	Peers KHE, Lysens RJJ	Sports Medicine	2005	144	8.47	Review	
Surgical treatment compared with eccentric training for patellar tendinopathy (jumper's knee) - A randomized, controlled trial	Bahr R, Fossan B, Løken S, Engebretsen L	journal of Bone and Joint Surgery-American Volume	2006	141	8.81	RCT	+
Isometric exercise induces analgesia and reduces inhibition in patellar tendinopathy	Rio E, Kidgell D, Purdam C, Gaida J, Moseley GL, Pearce AJ, Cook J	British Journal of Sports Medicine	2015	137	19.57	PRO	+
Fibril morphology and tendon mechanical properties in patellar tendinopathy effects of heavy slow resistance training	Kongsgaard M, Qvortrup K, Larsen J, Aagaard P, Doessing S, Hansen P, Kjaer M, Magnusson SP	American Journal of Sports Medicine	2010	131	10.92	PRO	+
Ultrasound guided dry needling and autologous blood injection for patellar tendinosis	James SL, Ali K, Pocock C, Robertson C, Walter J, Bell J, Connell D	British Journal of Sports Medicine	2007	130	8.67	PRO	+
Patellar tendinopathy: some aspects of basic science and clinical management	Khan KM, Maffulli N, Doleman BD, Cook JL, Taunton JE	British Journal of Sports Medicine	1998	130	5.42	Review	
Neovascularisation in chronic painful patellar tendinosis- promising results after sclerosing neovessels outside the tendon challenge the need for surgery	Alfredson H, Ohberg L	Knee Surgery Sports Traumatology Arthroscopy	2005	129	7.59	PRO	+
Patellar tendinopathy in junior basketball players: a controlled clinical and ultrasonographic study of 268 patellar tendons in players aged 14-18 years	Cook JL, Khan KM, Kiss ZS, Griffiths L	Scandinavian Journal of Medicine & Science in Sports	2000	123	5.59	Case-Control	-
The evolution of eccentric training as treatment for patellar tendinopathy (jumper's knee): a critical review of exercise programmes	Visnes H, Bahr R	British Journal of Sports Medicine	2007	120	8	Review	
Patellar tendinopathy: clinical diagnosis, load management, and advice for challenging case presentations	Malliaras P, Cook J, Purdam C, Rio E	Journal of Orthopaedic & Sports Physical Therapy	2015	110	15.71	Review	
Ultrasound-guided sclerosis of neovessels in painful chronic patellar tendinopathy- A randomized controlled trial	Hoksrud A, Ohberg L, Alfredson H, Bahr R	American Journal of Sports Medicine	2006	110	6.88	RCT	+
The effectiveness of extracorporeal shock wave therapy in lower limb tendinopathy a systematic review	Mani-Babu S, Morrissey D, Waugh C, Screen H, Barton C	American Journal of Sports Medicine	2015	109	15.57	Meta-Analysis	
Similar histopathological picture in males with Achilles and patellar tendinopathy	Maffulli N, Testa V, Capasso G, Ewen SW, Sullo A, Benazzo F, King JB	Medicine and Science in Sports and Exercise	2004	109	6.06	Case-Control	-
Comparative accuracy of magnetic resonance imaging and ultrasonography in confirming clinically diagnosed patellar tendinopathy	Warden Stuart J, Kiss Zoltan S, Malara Frank A, Ooi Alistair BT, Cook Jill L, Crossley Kay M	American Journal of Sports Medicine	2007	104	6.93	Case-Control	-

TABLE 1: General information related to the top 50 cited articles (sorted by total citations).

Title	Authors	Source title	Puplication year	Total citations	Citation index	Type of articles	Imaging
Prospective imaging study of asymptomatic patellar tendinopathy in elite junior basketball players	Cook JL, Khan KM, Kiss ZS, Purdam CR, Griffiths L	Journal of Ultrasound in Medicine	2000	100	4.55	PRO	-
No effect of eccentric training on jumper's knee in volleyball players during the competitive season - A randomized clinical trial	Visnes H, Hoksrud A, Cook J, Bahr R	Clinical Journal of Sport Medicine	2005	99	5.82	RCT	-
Excessive apoptosis in patellar tendinopathy in athletes	Lian O, Scott A, Engebretsen L, Bahr R, Duronio V, Khan K	American Journal of Sports Medicine	2007	98	6.53	Case-Control	-
Treatment of patellar tendinopathy-a systematic review of randomized controlled trials	Larsson Maria EH, Kall I, Nilsson-Helander K	Knee Surgery Sports Traumatology Arthroscopy	2012	94	9.4	Review	
Performance characteristics of volleyball players with patellar tendinopathy	Lian O, Refsnes PE, Engebretsen L, Bahr R	American Journal of Sports Medicine	2003	92	4.84	PRO	-
Reproducibility and clinical utility of tendon palpation to detect patellar tendinopathy in young basketball players	Cook JL, Khan KM, Kiss ZS, Purdam CR, Griffiths L	British Journal of Sports Medicine	2001	91	4.33	Case-Control	-
Open and arthroscopic patellar tenotomy for chronic patellar tendinopathy-A retrospective outcome study	Coleman BD, Khan KM, Kiss ZS, Bartlett J, Young DA, Wark JD	American Journal of Sports Medicine	2000	91	4.14	Case-Control	+
Anthropometry, physical performance, and ultrasound patellar tendon abnormality in elite junior basketball players: a cross-sectional study	Cook JL, Kiss ZS, Khan KM, Purdam CR, Webster KE	British Journal of Sports Medicine	2004	85	4.72	Case-Control	-
Skin-derived tenocyte-like cells for the treatment of patellar tendinopathy	Clarke AW, Alyas F, Morris T, Robertson CJ, Bell J, Connell DA	American Journal of Sports Medicine	2011	84	7.64	RCT	+
Low range of ankle dorsiflexion predisposes for patellar tendinopathy in junior elite basketball players a 1-year prospective study	Backman LJ, Danielson P	American Journal of Sports Medicine	2011	83	7.55	PRO	-
Pronociceptive and antinociceptive neuromediators in patellar tendinopathy	Lian Ø, Dahl J, Ackermann PW, Frihagen F, Engebretsen L, Bahr R	American Journal of Sports Medicine	2006	82	5.13	Case-Control	+
Changes in the composition of the extracellular matrix in patellar tendinopathy	Samiric T, Parkinson J, Ilic MZ, Cook J, Feller JA, Handley CJ	Matrix Biology	2009	81	6.23	Case-Control	-
Are unilateral and bilateral patellar tendinopathy distinguished by differences in anthropometry, body composition, or muscle strength in elite female basketball players?	Gaida JE, Cook JL, Bass SL, Austen S, Kiss ZS	British Journal of Sports Medicine	2004	81	4.5	Case-Control	-
Risk factors for patellar tendinopathy: a systematic review of the literature	van der Worp H, van Ark M, Roerink S, Pepping GJ, van den Akker-Scheek I, Zwerver J	British Journal of Sports Medicine	2011	80	7.27	Review	
Extracorporeal shockwave for chronic patellar tendinopathy	Wang CJ, Ko JY, Chan YS, Weng LH, Hsu SL	American Journal of Sports Medicine	2007	78	5.2	RCT	-
Eccentric treatment for patellar tendinopathy: a prospective randomised short-term pilot study of two rehabilitation protocols	Frohm A, Saartok T, Halvorsen K, Renstrom P	British Journal of Sports Medicine	2007	75	5	RCT	+
Comparison of effects of exercise programme, pulsed ultrasound and transverse friction in the treatment of chronic patellar tendinopathy	Stasinopoulos D, Stasinopoulos L	Clinical Rehabilitation	2004	74	4.11	RCT	-
No effect of extracorporeal shockwave therapy on patellar tendinopathy in jumping athletes during the competitive season a randomized clinical trial	Zwerver J, Hartgens F, Verhagen E, van der Worp H, van den Akker-Scheek I, Diercks RL	American Journal of Sports Medicine	2011	72	6.55	RCT	-
Extracorporeal shockwave therapy for patellar tendinopathy: a review of the literature	van Leeuwen MT, Zwerver J, van den Akker-Scheek I	British Journal of Sports Medicine	2009	71	5.46	Review	
Relationship between landing strategy and patellar tendinopathy in volleyball	Bisseling Rob W, Hof At L, Bredeweg Steef W, Zwerver J, Mulder T	British Journal of Sports Medicine	2007	71	4.73	Case-Control	-
Pain and activity levels before and after platelet-rich plasma injection treatment of patellar tendinopathy: a prospective cohort study and the influence of previous treatments	Gosens T, Den Oudsten BL, Fievez E, van 't Spijker P, Fievez A	International Orthopaedics	2012	70	7	PRO	-
Rehabilitation of Achilles and patellar tendinopathies	Kountouris A, Cook J	Best Practice & Research in Clinical Rheumatology	2007	69	4.6	Review	
Clinical features of patellar tendinopathy and their implications for rehabilitation	Crossley KM, Thancanamootoo K, Metcalf BR, Cook JL, Purdam CR, Warden SJ	Journal of Orthopaedic Research	2007	67	4.47	Case-Control	+
Biomechanical analysis of the single-leg decline squat	Zwerver J, Bredeweg SW, Hof AL	British Journal of Sports Medicine	2007	65	4.33	Case-Control	-
Landing strategies of athletes with an asymptomatic patellar tendon abnormality	Edwards S, Steele JR, McGhee DE, Beattie S, Purdam C, Cook JL	Medicine and Science in Sports and Exercise	2010	64	5.33	Case-Control	-
Treatment of chronic patellar tendinopathy with autologous bone marrow stem cells: a 5-year-follow up	Pascual-Garrido C, Rolon A, Makino A	Stem Cells International	2012	62	6.2	PRO	+
Physiotherapy management of patellar tendinopathy (jumper's knee)	Rudavsky A, Cook J	Journal of Physiotherapy	2014	61	7.63	Review	
Aprotinin, corticosteroids and normosaline in the management of patellar tendinopathy in athletes: a prospective randomized study	Capasso G, Testa V, Maffulli N, Bifulco G	Sports Exercise and Injury	1997	61	2.44	Case-Control	+
Changes in morphological and elastic properties of patellar tendon in athletes with unilateral patellar tendinopathy and their relationships with pain and functional disability	Zhang ZJ, Ng GY, Lee WC, Fu SN	Plos One	2014	60	7.5	Case-Control	+

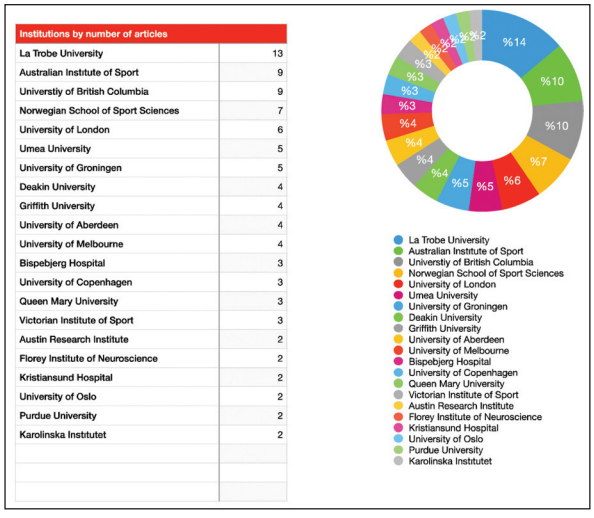

FIGURE 3: Institutional affiliation of the publications in the T50.

training and heavy slow resistance training in patellar tendinopathy" published by Kongsgaard et al., 37 patients with chronic patellar tendinopathy diagnosed based on clinical examination and ultrasonography were randomized into one of three groups: unilateral eccentric squats on a 25° decline board, 40 mg corticosteroid (methylprednisolone) to the peritendinous area or bilateral heavy slow resistance exercises including squats, leg press, and hack squats for 12 weeks.[9] The efficacy of the treatments was assessed using VISA and VAS scales. Follow-up examination at 12 weeks found significant improvement in VISA and VAS scores in all groups. Follow-up examination at 6 months, on the other hand, found a decrease in VISA and VAS scores in the corticosteroid group compared to week 12, while there was no significant change in these scores in the exercise therapy groups. Based on these findings, the authors reported that these treatments were similar in efficacy in the short term, but efficacy varied in the long term.Case-control studies, which represent the largest group in the T50, are preferred by clinicians for their retrospective nature, as they are easy to implement and allow for examining larger samples. On the other hand, RCT's are harder to conduct with a large sample size. Since a low sample size decreases the methodological quality of the articles, this may explain the discrepancy between the low levels of satisfaction with treatment in clinical practice and high rates of treatment success reported in publications.[65] Future studies designed as RCTs or prospective studies and

TABLE 2: H-indexes, impact factors, and Q categories of the journals in the T50.

Journals of the T50 articles	Number of articles	IF	H-index	Q classification
British Journal of Sports Medicine	14	03.05	171	Q1
American Journal of Sports Medicine	13	2.29	221	Q1
Scandinavian Journal of Medicine & Science in Sports	3	1.42	115	Q1
Sports Medicine	2	02.09	184	Q1
International Orthopaedics	2	1.26	90	Q1
Knee Surgery Sports Traumatology Arthroscopy	2	1.53	125	Q1
Medicine and Science in Sports and Exercise	2	1.76	224	Q1
Journal of Bone and Joint Surgery	1	0.91	260	Q1
Journal of Ultrasound	1	0.70	24	Q1
Matrix Biology	1	1.72	117	Q1
Best Practice Research in Clinical Rheumatology	1	0.70	100	Q1
Journal of Orthopaedic Research	1	1.33	155	Q1
Plos One	1	0.57	332	Q1
Sports Exercise and Injury	1	0.52	13	Q1
Journal of Orthopaedic & Sports Physical Therapy	1	1.51	121	Q1
Clinical Journal of Sport Medicine	1	1.08	102	Q1
Clinical Rehabilitation	1	1.39	110	Q1
Journal of Physiotherapy	1	1.99	68	Q1
Stem Cells Information	1	0.77	64	Q2

IF: Impact factors.

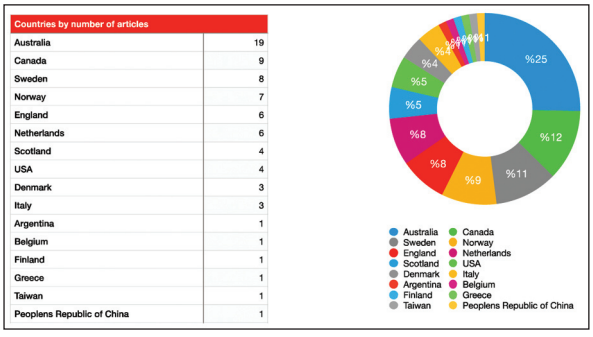

FIGURE 4: The countries of origin of the articles.

involving the largest possible sample size could reduce bias and increase reliability and accuracy.

Surgery may be indicated when conservative treatment fail and is represented with fewer articles: only 3 of the 50 most cited studies dealt with surgical treatment of the disease. However, the article with the highest number of citations was "Studies of surgical outcome after patellar tendinopathy: clinical significance of methodological deficiencies and guidelines for future studies". In this review, cited 517 times, the authors investigated the methodological quality of the articles and found a negative correlation between the reported success rates of surgical treatment and the methodological quality of the studies. This study found a positive correlation between the year of publication and methodological quality. Open patellar tendon tenotomy was the most commonly reported surgical method. The authors calculated the methodological quality using the Coleman Methodology Score and showed that the methodological score remained low even in articles published in recent years and made some recommendations for the design of future studies.

Our review found that nearly half of the 38 clinical articles in the T50 used the VISA questionnaire for the follow-up of patients. VISA questionnaires are widely used in the follow-up of patellar tendinopathy because they are free to use, do not require any equipment or training, and can be completed by patients in a short time. The 2019 International Scientific Tendinopathy Symposium consensus recommended the use of the VISA questionnaire in lower extremity tendinopathies.[66] One study by Korakakis et al. investigated the clinimetric properties of VISA questionnaires and reported that these questionnaires exhibited sufficient reliability, low measurement error, sufficient construct validity and responsiveness.[67] In the same study, the authors suggested modifying the VISA questionnaires for patients with lower extremity tendinopathy based on age, activity, and functional capacity.

Given that articles published in recent years need time to accrue citations, it is not surprising that articles published after 2015 did not appear in the T50. It can take 3 to 10 years for articles to reach their highest number of citations.[68] The total number of citations received by articles over years has steadily increased in the 2000s, with an average of approximately 500 citations in recent years, indicating that interest in this topic continues to grow.

More than half of the articles in the T50 were published in two journals: *The British Journal of Sports Medicine* and *the American Journal of Sports Medicine*. The 14 articles published in *the British Journal of Sports Medicine* received a total of 1,445 citations, while the 13 articles published in *the American Journal of Sports Medicine* received a total of 1,203 citations. These data show that these two journals possess the largest impact in the literature on patellar tendinopathy. Again, the fact that these two journals have the highest impact factors seems to be consistent with our data. Although these journals originate in the UK and the US, the most prolific country seems to be Australia and the most prolific institution seems to be La Trobe University in Australia. The prominence of Australia may be explained by the fact that Cook, found to be the most prolific author in our review, is from Australia and that this country supports sport science by using public policy and institutions such as the Australian Institute of Sport.[69]

Our study has some limitations: The search was done using only the Web of Science database and did not include other databases such as Google Scholar (Google, Califorina, USA) and Scopus, which may have affected the number of articles obtained. The study included only English-language articles. Including articles in other languages in the analysis can provide a broader perspective. Citation analyses did not consider self-citations and citation interactions.

Analyzing authors based on their branch could help reveal interdisciplinary approaches. Countries were not analyzed for productivity by income level, this is another limitation. Altmetric analyses were not included, which means that social media interactions of the articles were not revealed. There is a need for comprehensive studies that include larger databases, articles in other languages, altmetrics, and self-citation analyses.

CONCLUSION

Our review of T50 articles on patellar tendinopathy revealed a need for studies of higher methodological quality on this disease, for which there are many different treatment options. Again, future studies can achieve higher reliability by using objective questionnaires such as VISA to assess treatment efficacy and by using imaging methods such as ultrasonography to confirm the diagnosis of the disease. Furthermore, governments should consider allocating funds and establish regulatory committees composed of scientists for the development of sports science. The data presented in this study are intended to guide and contribute to further studies. Future studies should be conducted using larger databases and including articles in all languages and submetric analyses.

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