

Wetenschappelijke publicaties sportorthopedie: heup

- Boel F, Wortel J, van Buuren MMA, Rivadeneira F, van Meurs JBJ, Runhaar J, Bierma-Zeinstra SMA, Agricola R. DXA images vs. pelvic radiographs: reliability of hip morphology measurements. *Osteoarthritis Cartilage* 2025;33(2):283-292.
- Chen D, Boel F, van Klij P, van Buuren MMA, Bierma-Zeinstra SMA, Agricola R. The prevalence of primary cam morphology in early adolescents from the general population: a population-based study (generation R). *Osteoarthritis Cartilage* 2025, online ahead of print.
- Gomes DA, Heerey J, Scholes M, Mosler A, Jones D, Coburn S, Johnston R, Agricola R, Girdwood M, Pazzinatto MF, Kemp J. More is not always better – association between hip range of motion and symptom severity in patients with femoroacetabular impingement syndrome: a cross-sectional study. *Braz J Phys Ther* 2025;29(2):101189.
- Agricola R, van Buuren MMA, Kemp JL, Weinans H, Runhaar J, Bierma-Zeinstra SMA. Femoroacetabular impingement syndrome in middle-aged individuals is strongly associated with the development of hip osteoarthritis within 10-year follow-up: a prospective cohort study (CHECK). *Br J Sports Med* 2024;58(18):1061-1067.
- Boel F, Riedstra NS, Tang J, Hanff DF, Ahedi H, Arbabi V, Arden NK, Bierma-Zeinstra SMA, van Buuren MMA, Cicuttini FM, Cootes TF, Crossley K, Eygendaal D, Felson DT, Gielis WP, Heerey J, Jones G, Kluzek S, Lane NE, Lindner C, Lynch J, van Meurs J, Nelson AE, Mosler AB, Nevitt MC, Oei EH, Runhaar J, Weinans H, Agricola R. Reliability and agreement of manual and automated morphological radiographic hip measurements. *Osteoarthr Cartil Open* 2024;6(3):100510.
- Boel F, de Vos-Jakobs S, Riedstra NS, Lindner C, Runhaar J, Bierma-Zeinstra SMA, Agricola R. Automated radiographic hip morphology measurements: an open-access method. *Osteoarthr Imaging* 2024;4(2):100181.
- Claes PAM, Hanff DF, Weir A, Riedstra NS, Weinans H, Eygendaal D, Heerey J, Oei EHG, van Klij P, Agricola R. The association between the development of cam morphology during skeletal growth in high-impact athletes and the presence of cartilage loss and labral damage in adulthood: a prospective cohort study with a 12-year follow-up. *Am J Sports Med* 2024;52(10):2555-2564.
- Mosler AB, Heerey JJ, Kemp JL, Semciw AI, King MG, Agricola R, Lawrenson PR, Scholes MJ, Mentiplay BF, Crossley KM. Relationship between hip and groin pain and hip range of motion in amateur soccer and Australian rules football players. *Orthop J Sports Med* 2024;12(10):23259671241277662.
- Tang J, Boel F, van Buuren MMA, Riedstra NS, Runhaar J, Bierma-Zeinstra S, Agricola R. The different subtypes of cam morphology as defined by statistical shape modeling and their relationship with the development of hip osteoarthritis: a nationwide prospective cohort study (CHECK) with 10 years follow-up. *Osteoarthritis Cartilage* 2024;32(12):1647-1654.

- Tang J, van Buuren MMA, Boel F, Riedstra NS, van den Berg MA, Runhaar J, Bierma-Zeinstra S, Agricola R. The association between cam morphology and hip pain in males and females within 10 years: a national prospective cohort study (CHECK). *Semin Arthritis Rheum* 2024;69:152539.
- de Vos-Jakobs S, Boel F, Bramer WM, Bierma-Zeinstra SMA, Agricola R. Prevalence and radiological definitions of acetabular dysplasia after the age of 2 years: a systematic review. *J Pediatr Orthop B* 2024;33(4):334-339.
- Beddows TPA, Weir A, Agricola R, Tak IJR, Piscaer TM, Verhaar JAN, Klij PV. Hip and groin pain in male field hockey players: prevalence, incidence and associations with patient reported outcome scores and hip muscle strength. *Phys Ther Sport* 2023;61:66-72.
- Dijkstra HP, Mc Auliffe S, Ardern CL, Kemp JL, Mosler AB, Price A, Blazey P, Richards D, Farooq A, Serner A, McNally E, Mascarenhas V, Willy RW, Stankovic I, Oke JL, Khan KM, Glyn-Jones S, Clarke M, Greenhalgh T, Young Athlete's Hip Research (YAHIR) Collaborative. Infographic. Oxford consensus on primary cam morphology and femoroacetabular impingement syndrome- natural history of primary cam morphology to inform clinical practice and research priorities on conditions affecting the young person's hip. *Br J Sports Med* 2023;57(6):382-384.
- O'Brien MJM, Heerey J, Semciw AI, Mechlenburg I, Jacobsen JS, King MG, Scholes MJ, Lawrenson RR, Crossley K, Agricola R, Souza RB, Kemp JL. Does hip muscle strength and functional performance differ between football players with and without hip dysplasia? *Phys Ther Sport* 2023;64:1-7.
- O'Brien MJM, Kemp JL, Semciw AI, Mechlenburg I, Jacobsen JS, King MG, Scholes MJ, Lawrenson PR, Agricola R, Souza RB, Heerey J. Football players with hip dysplasia: the relationship between muscle strength, functional performance, self-reported sport and recreation, cartilage defects, and sex. A cross-sectional study. *J Orthop Sports Phys Ther* 2023;53(10):626-633.
- van Ovost A, Hanff DF, Serner A, van Klij P, Agricola R, Weir A. Radiographic assessment of the pubic symphysis in elite male adolescent football players: development and reliability of the Maturing Adolescent Pubis Symphysis (MAPS) classification. *Eur J Radiol* 2023;167:111068.
- Riedstra NS, Vinge R, Herfkens J, Eygendaal D, Bierma-Zeinstra SMA, Runhaar J, van Buuren MMA, Agricola R. Acetabular dysplasia and the risk of developing hip osteoarthritis at 2, 5, 8, and 10 years follow-up in a prospective nationwide cohort study (CHECK). *Semin Arthritis Rheum* 2023;60:152194.
- Scholes MJ, Mentiplay BF, Kemp JL, King MG, Schache AG, Heerey JJ, Sritharan P, Semciw AI, Agricola R, Crossley KM. Are hip biomechanics during running associated with symptom severity or cam morphology size in male football players with FAI syndrome? *Gait Posture* 2023;105:17-26.
- Tang J, van Buuren MMA, Riedstra NS, Boel F, Runhaar J, Bierma-Zeinstra S, Agricola R. Cam morphology is strongly and consistently associated with development of radiographic hip osteoarthritis throughout 4 follow-up visits in 10 years. *Osteoarthritis Cartilage* 2023;31(12):1650-1656.

- Ahedi H, Winzenberg T, Bierma-Zeinstra S, Blizzard L, van Middelkoop M, Agricola R, Waarsing JH, Cicuttini F, Jones G. A prospective cohort study on cam morphology and its role in progression of osteoarthritis. *Int J Rheum Dis* 2022;25(5):601-612.
- Ayeni OR, PREVIEW Pilot Investigators. Prospective evaluation of sport activity and the development of femoroacetabular impingement in the adolescent hip (PREVIEW): results of the pilot study. *Pilot Feasibility Stud* 2022;8(1):201.
- van Buuren MMA, Heerey JJ, Smith A, Crossley KM, Kemp JL, Scholes MJ, Lawrenson PR, King MG, Gielis WP, Weinans H, Lindner C, Souza RB, Verhaar JAN, Agricola R. The association between statistical shape modeling-defined hip morphology and features of early hip osteoarthritis in young adult football players: data from the femoroacetabular impingement and hip osteoarthritis cohort (FORCE) study. *Osteoarthr Cartil Open* 2022;4(3):100275.
- Herfkens J, van Buuren MMA, Riedstra NS, Verhaar JAN, Mascarenhas VV, Agricola R. Adding false-profile radiographs improves detection of developmental dysplasia of the hip, data from the CHECK cohort. *J Hip Preserv Surg* 2022;9(1):3-9.
- Scholes MJ, Kemp JL, Mentiplay BF, Heerey JJ, Agricola R, King MG, Semciw AI, Lawrenson PR, Crossley KM. Are cam morphology size and location associated with self-reported burden in football players with FAI syndrome? *Scand J Med Sci Sports* 2022;32(4):737-753.
- Scholes MJ, Kemp JL, Mentiplay BF, Heerey JJ, Agricola R, Semciw AI, Souza RB, Link TM, Majumdar S, King MG, Lawrenson PR, Crossley KM. Does femoroacetabular impingement syndrome affect self-reported burden in football players with hip and groin pain? *Sports Health* 2022;14(6):920-931.
- Heerey J, Agricola R, Smith A, Kemp J, Pizzari T, King M, Lawrenson P, Scholes M, Crossley K. The size and prevalence of bony hip morphology do not differ between football players with and without hip and/or groin pain: findings from the FORCE cohort. *J Orthop Sports Phys Ther* 2021;51(3):115-125.
- Heerey J, Kemp J, Agricola R, Srinivasan R, Smith A, Pizzari T, King M, Lawrenson P, Scholes M, Link T, Souza R, Majumdar S, Crossley K. Cam morphology is associated with MRI-defined cartilage defects and labral tears: a case-control study of 237 young adult football players with and without hip and groin pain. *BMJ Open Sport Exerc Med* 2021;7(4):e001199.
- Heerey JJ, Srinivasan R, Agricola R, Smith A, Kemp JL, Pizzari T, King MG, Lawrenson PR, Scholes MJ, Souza RB, Link T, Majumdar S, Crossley KM. Prevalence of early hip OA features on MRI in high-impact athletes. The femoroacetabular impingement and hip osteoarthritis cohort (FORCE) study. *Osteoarthritis Cartilage* 2021;29(3):323-334.
- Kemp JL, Østerås N, Mathiessen A, Nordsletten L, Agricola R, Waarsing JH, Heerey JJ, Risberg MA. Relationship between cam morphology, hip symptoms, and hip osteoarthritis: the Musculoskeletal pain in Ullersaker Study (MUST) cohort. *Hip Int* 2021;31(6):789-796.
- van Klij P, Heijboer MP, Ginai AZ, Verhaar JAN, Waarsing JH, Agricola R. Clinical and radiological hip parameters do not precede, but develop simultaneously with cam morphology: a 5-year follow-up study. *Knee Surg Sports Traumatol Arthrosc* 2021;29(5):1401-1410.

- van Klij P, Heijboer MP, Ginai AZ, Verhaar JAN, Waarsing JH, Agricola R. Correction to: Clinical and radiological hip parameters do not precede, but develop simultaneously with cam morphology: a 5-year follow-up study. *Knee Surg Sports Traumatol Arthrosc* 2021;29(5):1411-1412.
- van Klij P, Langhout R, van Beijsterveldt AMC, Stubbe JH, Weir A, Agricola R, Fokker Y, Mosler AB, Waarsing JH, Verhaar J, Tak I. Do hip and groin muscle strength and symptoms change throughout a football season in professional male football players? A prospective cohort study with repeated measures. *J Sci Med Sport* 2021;24(11):1123-1129.
- Reiman MP, Agricola R, Kemp JL, Heerey JJ, Weir A, van Klij P, Kassarian A, Mosler AB, Ageberg E, Hölmich P, Warholm KM, Griffin D, Mayes S, Khan KM, Crossley KM, Bizzini M, Bloom N, Casartelli NC, Diamond LE, Di Stasi S, Drew M, Friedman DJ, Freke M, Glyn-Jones S, Gojanovic B, Harris-Hayes M, Hunt MA, Impellizzeri FM, Ishøi L, Jones DM, King MG, Lawrenson PR, Leunig M, Lewis CL, Mathieu N, Moksnes H, Risberg MA, Scholes MJ, Semciw AI, Serner A, Thorborg K, Virgile A, Wörner T, Dijkstra HP. Infographic. Consensus recommendations on the classification, definition and diagnostic criteria of hip-related pain in young and middle-aged active adults from the International Hip-related Pain Research Network, Zurich 2018. *Br J Sports Med* 2021;55(2):115-117.
- Impellizzeri FM, Jones DM, Griffin D, Harris-Hayes M, Thorborg K, Crossley KM, Reiman MP, Scholes MJ, Ageberg E, Agricola R, Bizzini M, Bloom N, Casartelli NC, Diamond LE, Dijkstra HP, Di Stasi S, Drew M, Friedman DJ, Freke M, Gojanovic B, Heerey JJ, Hölmich P, Hunt MA, Ishøi L, Kassarian A, King M, Lawrenson PR, Leunig M, Lewis CL, Warholm KM, Mayes S, Moksnes H, Mosler AB, Risberg MA, Semciw A, Serner A, van Klij P, Wörner T, Kemp J. Patient-reported outcome measures for hip-related pain: a review of the available evidence and a consensus statement from the International Hip-related Pain Research Network, Zurich 2018. *Br J Sports Med* 2020;54(14):848-857.
- Kemp JL, Risberg MA, Mosler A, Harris-Hayes M, Serner A, Moksnes H, Bloom N, Crossley KM, Gojanovic B, Hunt MA, Ishøi L, Mathieu N, Mayes S, Scholes MJ, Gimpel M, Friedman D, Ageberg E, Agricola R, Casartelli NC, Diamond LE, Dijkstra HP, Di Stasi S, Drew M, Freke M, Griffin D, Heerey J, Hölmich P, Impellizzeri FM, Jones DM, Kassarian A, Khan KM, King MG, Lawrenson PR, Leunig M, Lewis CL, Warholm KM, Reiman MP, Semciw A, Thorborg K, van Klij P, Wörner T, Bizzini M. Physiotherapist-led treatment for young to middle-aged active adults with hip-related pain: consensus recommendations from the International Hip-related Pain Research Network, Zurich 2018. *Br J Sports Med* 2020;54(9):504-511.
- van Klij P, Ginai AZ, Heijboer MP, Verhaar JAN, Waarsing JH, Agricola R. The relationship between cam morphology and hip and groin symptoms and signs in young male football players. *Scand J Med Sci Sports* 2020;30(7):1221-1231.
- van Klij P, Reiman MP, Waarsing JH, Reijman M, Bramer WM, Verhaar JAN, Agricola R. Classifying cam morphology by the alpha angle: a systematic review on threshold values. *Orthop J Sports Med* 2020;8(8):2325967120938312.
- Mosler AB, Kemp J, King M, Lawrenson PR, Semciw A, Freke M, Jones DM, Casartelli NC, Wörner T, Ishøi L, Ageberg E, Diamond LE, Hunt MA, Di Stasi S, Reiman MP, Drew M, Friedman D, Thorborg K, Leunig M, Bizzini M, Khan KM, Crossley KM, Agricola R, Bloom N, Dijkstra HP, Griffin D, Gojanovic B, Harris-Hayes M, Heerey JJ, Hölmich P, Impellizzeri FM, Kassarian A, Warholm KM, Mayes S, Moksnes H, Risberg MA, Scholes MJ, Serner A, van Klij P, Lewis CL. Standardised measurement of physical capacity in young and middle-aged active adults with hip-

related pain: recommendations from the first International Hip-related Pain Research Network (IHiPRN) meeting, Zurich, 2018. Br J Sports Med 2020;54(12):702-710.

- Öhlin A, Simunovic N, Duong A, Ayeni OR; PREVIEW investigators. Protocol for a multicenter prospective cohort study evaluating sport activity and development of femoroacetabular impingement in the adolescent hip. BMC Musculoskelet Disord 2020;21(1):221.
- Reiman MP, Agricola R, Kemp JL, Heerey JJ, Weir A, van Klij P, Kassarian A, Mosler AB, Ageberg E, Hölmich P, Warholm KM, Griffin D, Mayes S, Khan KM, Crossley KM, Bizzini M, Bloom N, Casartelli NC, Diamond LE, Di Stasi S, Drew M, Friedman DJ, Freke M, Gojanovic B, Glyn-Jones S, Harris-Hayes M, Hunt MA, Impellizzeri FM, Ishøi L, Jones DM, King MG, Lawrenson PR, Leunig M, Lewis CL, Mathieu N, Moksnes H, Risberg MA, Scholes MJ, Semciw AI, Serner A, Thorborg K, Wörner T, Dijkstra HP. Consensus recommendations on the classification, definition and diagnostic criteria of hip-related pain in young and middle-aged active adults from the International Hip-related Pain Research Network, Zurich 2018. Br J Sports Med 2020;54(11):631-641.
- Heerey JJ, Kemp JL, Mosler AB, Jones DM, Pizzari T, Scholes MJ, Agricola R, Crossley KM. What is the prevalence of hip intra-articular pathologies and osteoarthritis in active athletes with hip and groin pain compared with those without? A systematic review and meta-analysis. Sports Med 2019;49(6):951-972.
- Heerey JJ, Kemp JL, Mosler AB, Jones DM, Pizzari T, Scholes MJ, Agricola R, Crossley KM. Correction to: What is the prevalence of hip intra-articular pathologies and osteoarthritis in active athletes with hip and groin pain compared with those without? A systematic review and meta-analysis. Sports Med 2019;49(7):1139-1141.
- van Klij P, Heijboer MP, Ginai AZ, Verhaar JAN, Waarsing JH, Agricola R. Cam morphology in young male football players mostly develops before proximal femoral growth plate closure: a prospective study with 5-year follow-up. Br J Sports Med 2019;53(9):532-538.
- Crossley KM, Pandy MG, Majumdar S, Smith AJ, Agricola R, Semciw AI, Kemp JL, Heerey JJ, King MG, Lawrenson PR, Lin YC, Souza RB, Mosler AB, Link TM, Srinivasan R, Schache AG. Femoroacetabular impingement and hip Osteoarthritis Cohort (FORCE): protocol for a prospective study. J Physiother 2018;64(1):55.
- Kemp JL, Crossley KM, Agricola R, Geuskens F, van Middelkoop M. Radiographic hip osteoarthritis is prevalent, and is related to cam deformity 12-24 months post-hip arthroscopy. Int J Sports Phys Ther 2018;13(2):177-184.
- King MG, Semciw AI, Hart HF, Schache AG, Middleton KJ, Heerey JJ, Agricola R, Crossley KM. Sub-elite football players with hip-related groin pain and a positive flexion, adduction, and internal rotation test exhibit distinct biomechanical differences compared with the asymptomatic side. J Orthop Sports Phys Ther 2018;48(7):584-593.
- van Klij P, Heerey J, Waarsing JH, Agricola R. The prevalence of cam and pincer morphology and its association with development of hip osteoarthritis. J Orthop Sports Phys Ther 2018;48(4):230-238.

- Mosler AB, Agricola R, Thorborg K, Weir A, Whiteley RJ, Crossley KM, Hölmich P. Is bony hip morphology associated with range of motion and strength in asymptomatic male soccer players? J Orthop Sports Phys Ther 2018;48(4):250-259.
- Mosler AB, Weir A, Serner A, Agricola R, Eirale C, Farooq A, Bakken A, Thorborg K, Whiteley RJ, Hölmich P, Bahr R, Crossley KM. Musculoskeletal screening tests and bony hip morphology cannot identify male professional soccer players at risk of groin injuries: a 2-year prospective cohort study. Am J Sports Med 2018;46(6):1294-1305.
- Taylor R, Vuckovic Z, Mosler A, Agricola R, Otten R, Jacobsen P, Holmich P, Weir A. Multidisciplinary assessment of 100 athletes with groin pain using the Doha Agreement: high prevalence of adductor-related groin pain in conjunction with multiple causes. Clin J Sport Med 2018;28(4):364-369.
- Saberi Hosnijeh F, Zuiderwijk ME, Versteeg M, Smeele HT, Hofman A, Uitterlinden AG, Agricola R, Oei EH, Waarsing JH, Bierma-Zeinstra SM, van Meurs JB. Cam deformity and acetabular dysplasia as risk factors for hip osteoarthritis. Arthritis Rheumatol 2017;69(1):86-93.
- Agricola R, Weinans H. Femoroacetabular impingement: what is its link with osteoarthritis? Br J Sports Med 2016;50(16):957-958.
- Agricola R, Weinans H. What causes cam deformity and femoroacetabular impingement: still too many questions to provide clear answers. Br J Sports Med 2016;50(5):263-264.
- Agricola R, Weinans H. What is femoroacetabular impingement? Br J Sports Med 2016;50(4):196-197.
- Griffin DR, Dickenson EJ, O'Donnell J, Agricola R, Awan T, Beck M, Clohisy JC, Dijkstra HP, Falvey E, Gimpel M, Hinman RS, Hölmich P, Kassarian A, Martin HD, Martin R, Mather RC, Philippon MJ, Reiman MP, Takla A, Thorborg K, Walker S, Weir A, Bennell KL. The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement. Br J Sports Med 2016;50(19):1169-1176.
- Mosler AB, Crossley KM, Waarsing JH, Jomaah N, Weir A, Hölmich P, Agricola R. Ethnic differences in bony hip morphology in a cohort of 445 professional male soccer players. Am J Sports Med 2016;44(11):2967-2974.
- Tak I, Glasgow P, Langhout R, Weir A, Kerkhoffs G, Agricola R. Hip range of motion is lower in professional soccer players with hip and groin symptoms or previous injuries, independent of cam deformities. Am J Sports Med 2016;44(3):682-688.
- Mosler AB, Agricola R, Weir A, Hölmich P, Crossley KM. Which factors differentiate athletes with hip/groin pain from those without? A systematic review with meta-analysis. Br J Sports Med 2015;49(12):810.
- Tak I, Weir A, Langhout R, Waarsing JH, Stubbe J, Kerkhoffs G, Agricola R. The relationship between the frequency of football practice during skeletal growth and the presence of a cam deformity in adult elite football players. Br J Sports Med 2015;49(9):630-634.
- Agricola R, Heijboer MP, Ginai AZ, Roels P, Zadpoor AA, Verhaar JA, Weinans H, Waarsing JH. A cam deformity is gradually acquired during skeletal maturation in adolescent and young male

soccer players: a prospective study with minimum 2-year follow-up. Am J Sports Med 2014;42(4):798-806.

- Agricola R, Waarsing JH, Thomas GE, Carr AJ, Reijman M, Bierma-Zeinstra SM, Glyn-Jones S, Weinans H, Arden NK. Cam impingement: defining the presence of a cam deformity by the alpha angle: data from the CHECK cohort and Chingford cohort. Osteoarthritis Cartilage 2014;22(2):218-225.
- Agricola R, Waarsing JH, Thomas GE, Carr AJ, Reijman M, Bierma-Zeinstra SM, Glyn-Jones S, Weinans H, Arden NK. Response to letter to the editor: "Cam impingement: defining the presence of a cam deformity by the alpha angle data from the CHECK cohort and Chingford cohort". Osteoarthritis Cartilage 2014;22(12):2095-2096.
- Roels P, Agricola R, Oei EH, Weinans H, Campoli G, Zadpoor AA. Mechanical factors explain development of cam-type deformity. Osteoarthritis Cartilage 2014;22(12):2074-82.
- Agricola R, Heijboer MP, Bierma-Zeinstra SM, Verhaar JA, Weinans H, Waarsing JH. Cam impingement causes osteoarthritis of the hip: a nationwide prospective cohort study (CHECK). Ann Rheum Dis 2013;72(6):918-923.
- Agricola R, Heijboer MP, Roze RH, Reijman M, Bierma-Zeinstra SM, Verhaar JA, Weinans H, Waarsing JH. Pincer deformity does not lead to osteoarthritis of the hip whereas acetabular dysplasia does: acetabular coverage and development of osteoarthritis in a nationwide prospective cohort study (CHECK). Osteoarthritis Cartilage 2013;21(10):1514-1521.
- Agricola R, Waarsing JH, Arden NK, Carr AJ, Bierma-Zeinstra SM, Thomas GE, Weinans H, Glyn-Jones S. Cam impingement of the hip: a risk factor for hip osteoarthritis. Nat Rev Rheumatol 2013;9(10):630-634.
- Sankar WN, Nevitt M, Parvizi J, Felson DT, Agricola R, Leunig M. Femoroacetabular impingement: defining the condition and its role in the pathophysiology of osteoarthritis. J Am Acad Orthop Surg 2013;21 Suppl 1:S7-S15.
- Agricola R, Bessems JH, Ginai AZ, Heijboer MP, van der Heijden RA, Verhaar JA, Weinans H, Waarsing JH. The development of Cam-type deformity in adolescent and young male soccer players. Am J Sports Med 2012;40(5):1099-1106.
- Tijssen M, van Cingel R, van Melick N, de Visser E. Patient-reported outcome questionnaires for hip arthroscopy: a systematic review of the psychometric evidence. BMC Musculoskelet Disord 2011;12:117.