Application of bodybuilding for correction of musculoskeletal disease in Patellofemoral Pain Syndrome - a case report

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Abstract
Background: Medicine and Physical Education can work together to solve many health problems. Bodybuilding is a multidisciplinary area whose goals can range from body development to the correction of postural problems and the resolution of various pathologies related to human movement. In the case in analysis, the patient presented (at rest) localized pain (twinges) in the anterior face of the left knee, with an intensity of five (0-10 scale), without phlogistic signs, which worsens when performing the squat, hindering him from leaving the bed without pain. Symptoms were exacerbated when descending stairs. Through anamnesis and directed physical examination, it were considered the possible differential diagnosis of pain in the anterior portion of the knee: Diseases in menisci, anterior and posterior cruciate ligament injuries, diseases of knee collateral ligaments, diseases of knee cartilage, diseases of patellar tendon tendinitis and patellar chondromalacia. After a correct diagnosis of patellofemoral pain syndrome, a conservative treatment was performed using bodybuilding. The results were positive after four months of treatment. From this case, it can be concluded that bodybuilding can be an alternative solution for the conservative treatment of Patellofemoral Pain Syndrome.

1. INTRODUCTION
This case report describes a case of knee pain treatment through bodybuilding, in which it was possible to end the pain and allow the subjective to return to normal activity after four months of clinical intervention, which occurred after two years without treatment success. According to Patel A. ⁷ (2007), the differential diagnoses for pain complaints on the anterior face of the knee, are numerous. However, after careful evaluation of the patient, it was possible to do the correct diagnosis of the Patellofemoral Pain Syndrome (PFPS), enabling the therapeutic success.
The knee pain, especially pain related to Patellofemoral Pain Syndrome, has a high prevalence in society, affecting mainly females in the ratio of two women for one man, with an incidence of approximately 11-14% of physically inactive population, 25-40% of the people practicing physical exercises, and 36% of cyclists (Collins et al., 2018; Crossley, Stefanik, et al., 2016; Crossley, Van Middelkoop, et al., 2016; Powers, Witvrouw, Davis, & Crossley, 2017; Smith et al., 2018; Van Middelkoop, Van Linschoten, Berger, Koes, & Biema-Zeinstra, 2008; Wood, Muller, & Peat, 2011). In the present case study, there was a failure in the initial treatment (Gao, Zhong, & Wang, 2018; Porto, 2017; Porto & Porto, 2013; Rolf, 2007), making the patient stay two years with the same problem and with the prognosis getting worse. Considering the risk of poor prognosis in the treatment, the correct diagnosis is fundamental, in this case the wrong diagnosis has not permitted the correct choice of therapeutic line. According to Christer Rolf (2007) the non-absolute closure of the diseases diagnosis, such as Patellar Chondromalacia, is the career’s end of many young athletes. In the case under analysis, the patient reports that, since the period of the first incident, the doctor did not share his diagnosis. It was used the standard CARE standard (Gagnier et al., 2013) in the case description. The main objective of this case study was to apply the bodybuilding method as a conservative treatment for Patellofemoral Pain Syndrome, and, as a secondary aim, to demonstrate that a good anamnesis and physical examination are fundamental for a correct diagnosis.

2. CASE STUDY

HMSF, 25 years old, Caucasian male, student, motorcycle rider, motocross practitioner, works part-time as a receptionist at a Portuguese fitness academy. He presented as the main complaint: pain in the anterior face of the knee, with difficulties in walking and going down stairs. History of the present illness: at the age of 22, in 2015, he fell while riding a motorcycle, doing motocross at a low speed. He presented pain (twinge) in the left knee with localized character, with an intensity of five (in a scale from 0 to 10), with a lot of discomfort when getting up and when doing the squat, without phlogistic signs in the area. He reported that he was using the safety protectors of motorcyclists. He was assisted at the hospital by the medical team and a radiography on the lower limbs was performed showing no fracture. He was treated with non-steroidal anti-inflammatory (Diclofenac Sodium 50mg every 8 hours) for 2-3 days, and ice during 10 min for 2-3 times per day. At the time, he reported that, when taking the medication, he did not present intense pain, allowing him to do daily activities while the medication was acting. Three days after the use of the medicine, he returned to practice Motocross, referring that when he positioned in order to sit on the motorcycle, he felt a slight pain. However, at the end of 3 hours of training, he returned to experience more intense pain, with no change in pain’s character. He was advised by his doctor to maintain the medication and was oriented to a physical therapy service.

In January 2015, he began the treatment with physiotherapy, completing 30 sessions in approximately two and a half years until May 2017, reporting no improvement, having intermittent pain during the day. He received several physical therapy treatments without any signs of improvement. This treatment failed to keep him from pain during his motocross training and daily activities. Pain accompanied him for 2-3 days after practicing. He reported worsening pain when performing the squat movement, climbing stairs and down stairs.

Over the two years, the pain gradually increased reaching an intensity of 8-10 in the scale of 0-10, when performing the squat movement. The pain hindered him when getting out of bed and going up and down stairs after training motocross, or when he was at his work over two hours without any pain.

In May 2017, he sought for the help of a Sport Sciences Professional (Personal Trainer) and a Medicine Professional that, through detailed anamnesis and physical examination, diagnosed Patellofemoral Pain Syndrome, hypertrophy of the left gluteus maximus, knee valgus, defining, as treatment, muscle strengthening.
During 3-4 months of treatment, the patient presented reduction of pain without medication, maintaining a regular localized training, at least 3 times a week, until having a muscular balance with strengthening of the weakened area, leading to the end of pain and absence of complaint after the return the motocross activities, as well as in daily activity.

The patient expressed the desire to continue practicing motocross, as it is his favorite sport. He did not present in his anamnesis any change concerning his health history, denying the common childhood diseases, or any other disease. He describes that he has always showed a compatible growth with age and that he always practiced physical exercise. Regarding his family history, no family diseases related to his pain were found.

### 2.1 Clinical findings

The physical examination was divided into two stages, the static physical examination (Figure 1) and the dynamic physical examination (Figure 2). In the ectoscopy it was observed: knees valgus, increased muscular volume in the right lower limb when comparing to the left one. Maneuvers and palpation were performed to evaluate menisci, collateral ligaments, patellar tendon, anterior and posterior cruciate ligaments.

![Patient Static Evaluation](image1)

**Figure 1. Patient Static Evaluation**

- (A) Patient's ectoscopy, observing the muscular volume of the left leg greater than the right, and knee valgus.
- (B) Measurement of lower limbs.
- (C) Evaluation of the Meniscus Apley Test.
- (D) Tibial plateau evaluation with palpation of the meniscus, as well as the test of the anterior drawer of the anterior cruciate ligament and the palpation of the patellar tendon, and its fixation of the tibial tuberosity.
- (E) Evaluation of medial structures of the knee articulation.

After static evaluation, dynamic evaluation was performed (Figure 2), with a strength test (Moura, 1997) for lower limbs, with evaluation of the quadriceps and posterior thigh muscles. Double Leg and Single Leg tests were performed.

![Patient Dynamic Evaluation](image2)

**Figure 2. Patient Dynamic Evaluation**

- (A) Hyper valgism in the squat movement;
- (B) Thighs Posterior evaluation;
- (C) Evaluation of Medium and Minimum Muscle Buttocks;
- (D) Quadriceps strength evaluation;
- (E) Evaluation of strength of the Glute Maximum of the knee articulations.
For identifying instability in the final movement of the double leg squats, failing to complete the 90 degrees and inability to perform the single leg movement due to pain and insecurity of the patient, hip adduction with hyper valgism was observed during the double leg movement, and the strength of the gluteus medius and minimum muscles during the movement of leg abduction with resistance was evaluated through gym equipment. The strength of the gluteus maximum was evaluated with the hip trust movement, in which the patient reported mild pain and instability of the left leg and the left side of the buttock.

2.2 Diagnostic evaluation

After anamnesis and physical examination, the main diagnostic hypothesis was Patellofemoral Syndrome Pain - patellar chondromalacia, related to muscular disequilibrium. The diseases of the meniscus, injuries of the anterior and posterior cruciate ligament, diseases of the collateral ligaments and the cartilage and tendinitis of the knee and patellar tendon, were disregarded through physical examinations.

It was proposed bodybuilding training, three times a week, Table 1. The recovery time expected for pain improvement and the return to motocross activities was approximately 3-4 months. All treatment occurred without adverse effects reported by the patient.

| Months       | 0-3 (may - july) | 4-6 (august - october) | 6-9 (november - january) | 9-12 (february- april) |
|--------------|------------------|------------------------|--------------------------|------------------------|
| Applied exercises | Abductor chair | Isometric squat with Swiss Ball | Squats on Smith | Squats on Smith |
|               | 1-               | 2-                     | 1-                        | 1-                      |
| Load per exercise | 2- free(no weight) | 3-                      | 2- Pelvic Elevation | 2- Pelvic Elevation |
|               | 1- 50 kg | 2- 10 kg | 1- 10 kg | 1- 25kg |
|               | 3- 10 kg |              | 2- 17.5kg | 2- 30 kg |
|               |              | 3- 60 kg | 3- 60 kg | 3- 100kg |
|               |              | 4- 70kg | 4- 70kg | 4- 70kg |
| Weekly training volume | 1x per week | 2x per week | 2x per week | 2x per week |
| Complaints | Lack of strength, acute pain in the left knee zone | Lack of strength, acute pain sporadically in the left knee zone, without pain at rest | Lack of confidence in the performance of movements. No pain reported | No complaints reported |

2.3 Follow-up

Through a new evaluation on September 1, 2018, one year after pain cessation (Figure 3): the patient showed significant improvement in the muscle groups’ strength, without complaint at rest or after 3-hour motocross training. However, after the dynamic assessment of the patient it was perceived an instability of the movements performed with the left leg support during the single leg, with disequilibrium, hyper valgism of the movement, and equilibrium compensation with arms movements related to the right side. It was also observed that during the hip trust, the patient still reported mild instability of the left lower limb. However, with significant improvement of movement biomechanics and strength compared to the beginning of treatment.

From this new evaluation the patient reported that thigh flexion movement with extended leg during the curves in motocross training was still difficult, with the left leg posing as support. Herewith, treatment and training with maintaining quadriceps strength and strengthening the buttocks to improve knee stability was performed, introducing training proprioception and isometrics to maintain strength and muscle mass without pain and daily activity restrictions, as well as to allow him to improve the performance in motocross.
3. FINAL REMARKS

Patellofemoral Pain Syndrome presents a high prevalence in society, affecting 25-40% of the physically active population currently. The Patellofemoral Pain Syndrome is the major cause of medical care related to musculoskeletal diseases of the lower limbs, capable of generating temporary or definitive discharge of athletes and workers (Blond & Hansen, 1998; Callaghan & Selfe, 2007; Fairbank, Pynsent, van Poortvliet, & Phillips, 1984; Halabchi, Abolhasani, Mirshahi, & Alizadeh, 2017; Hall, Foss, Hewett, & Myer, 2015; Myer et al., 2010; Rathleff, Rathleff, Olesen, Rasmussen, & Roos, 2016).

The considered risk factors of aggravation or sprouting of Patellofemoral Pain Syndrome are: knee valgus, contact areas between the patella and the femur, disequilibrium of the quadriceps and gluteous muscle, more specifically, in the strength muscle loss of the medium gluteus since it is the main knee articulations stabilizer (Barton et al., 2014; Contreras, Vigotsky, Schoenfeld, Beardsley, & Cronin, 2015; Kim, Unger, Lanovaz, & Oates, 2016; Shanbehzadeh et al., 2014; Souza & Powers, 2009).

Treatment of the Patellofemoral Pain Syndrome must be wide to correct all the aggravating gaps. Thus, the physical examination with complete and detailed anamnesis is fundamental for the correct diagnosis and effective therapy. In the case in question, it was possible to apply a training plan through bodybuilding exercises that could solve the muscular disequilibrium of the patient (Collins et al., 2018; Crossley, Van Middelkoop, et al., 2016; Powers et al., 2017).

The limitation of this case can be represented by the difficulty of using a single guideline with bodybuilding treatments for the general population, when therapeutic individualization is required in each case of patients with PFPS.

It can be stated that anamnesis and physical examination should not be neglected, and, when provided with proper attention, it is possible to do the correct diagnosis, making use of the complementary exams when they are necessary. Even with a predisposition for the appearance PFPS, in patients with knee in valgus (Collins et al., 2018; Powers et al., 2017), the maintenance of muscle mass is undoubtedly the best way for healthy articulations, avoiding muscle injuries and increasing the ability to withstand overuse of muscles and muscle overload in daily tasks.

**From the patient's perspective:** The patient reported after being asked: What did you expect before you started treatment and how do you see the results in the first 6 months and currently?

"I expected to not feel pain; it was uncomfortable to live with pain even in the most basic movements. I wanted results in three months, but it took longer. The satisfaction and
accomplishment of doing a mere squatting without load and without pain was the best moment in a long time. I really felt fulfilled and complete with the training"

Informed consent form:

The Informed Consent Form was applied to the Patient Based on Annex A of ISO 12894:2001 (Organization for Standardization (ISO), 2001).

References

Barton, C. J., Kennedy, A., Twycross-Lewis, R., Woledge, R., Malliaras, P., & Morrissey, D. (2014). Gluteal muscle activation during the isometric phase of squatting exercises with and without a Swiss ball. Physical Therapy in Sport, 15(1), 39–46. https://doi.org/10.1016/J.PTSP.2013.02.006

Błond, L., & Hansen, L. (1998). Patellofemoral pain syndrome in athletes: A 5.7-Year retrospective follow-up study of 250 athletes. Acta Orthopaedica Belgica, 64(4), 393–400. Retrieved from http://www.actaorthopaedica.be/acta/download/1998-4/9922542.pdf

Callaghan, M. J., & Selfe, J. (2007). Has the incidence or prevalence of patellofemoral pain in the general population in the United Kingdom been properly evaluated? Physical Therapy in Sport, 8(1), 37–43. https://doi.org/10.1016/J.PTSP.2006.07.001

Collins, N. J., Barton, C. J., van Middelkoop, M., Callaghan, M. J., Rathleff, M. S., Vicenzino, B. T., ... 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

Contreras, B., Vigotsky, A. D., Schoenfeld, B. J. B. J., Beardsley, C., & Cronin, J. (2015). A Comparison of Gluteus Maximus, Biceps Femoris, and Vastus Lateralis Electromyographic Activity in the Back Squat and Barbell Hip Thrust Exercises. Journal of Applied Biomechanics, 31(6), 452–458. https://doi.org/10.1123/jab.2014-0301

Crossley, K. M., Stefanik, J. J., Selfe, J., Collins, N. J., Davis, I. S., Powers, C. M., ... Callaghan, M. J. (2016). 2016 Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester. Part 1: Terminology, definitions, clinical examination, natural history, patellofemoral osteoarthritis and patient-reported outcome m. Br J Sports Med, 50(14), 839–843. https://doi.org/10.1136/bjsports-2016-096384

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). Br J Sports Med, 50(14), 844–852. https://doi.org/10.1136/bjsports-2016-096268

Fairbank, J. C., Pynsent, P. B., van Poortvliet, J. A., & Phillips, H. (1984). Mechanical factors in the incidence of knee pain in adolescents and young adults. The Journal of Bone and Joint Surgery. British Volume, 66(5), 685–693. https://doi.org/10.1302/0301-620X.66B5.6501361

Gagnier, J. J., Kienle, G., Altman, D. G., Moher, D., Sox, H., Riley, D., ... Tugwell, P. (2013). The CARE guidelines: consensus-based clinical case reporting guideline development. BMJ Case Reports, 2013, bcr2013201554. https://doi.org/10.1136/bcr-2013-015554

Gao, L. N., Zhong, B., & Wang, Y. (2018). Rheumatoid arthritis-like features in Hansen disease: A case report. Medicine, 97(29), e11590. https://doi.org/10.1097/MD.0000000000011590

Halabchi, F., Abolhasani, M., Mirshahi, M., & Alizadeh, Z. (2017). Patellofemoral pain in athletes: clinical perspectives. Open Access Journal of Sports Medicine, 8, 189–203. https://doi.org/10.2147/OAJSM.S127359

Hall, R., Foss, K. B., Hewett, T. E., & Myer, G. D. (2015). Sport Specialization’s Association with an Increased Risk of Developing Anterior Knee Pain in Adolescent Female Athletes. Journal of Sport Rehabilitation, 24(1), 31–35. https://doi.org/10.1123/jsr.2013-0101
Kim, D., Unger, J., Lanovaz, J. L., & Oates, A. R. (2016). The Relationship of Anticipatory Gluteus Medius Activity to Pelvic and Knee Stability in the Transition to Single-Leg Stance. PM&R, 8(2), 138–144. https://doi.org/10.1016/J.PMRJ.2015.06.005

Moura, J. (1997). Força máxima dinâmica: proposta metodológica para validação do teste de 1RM. Kinesis (Vol. 18).

Myer, G. D., Ford, K. R., Barber Foss, K. D., Goodman, A., Ceasar, A., Rauh, M. J., ... Hewett, T. E. (2010). The incidence and potential pathomechanics of patellofemoral pain in female athletes. Clinical Biomechanics (Bristol, Avon), 25(7), 700–707. https://doi.org/10.1016/j.clinbiomech.2010.04.001

Organization for Standardization (ISO). (2001). ISO 12894 (2001) Ergonomics of the thermal environment—Medical supervision of individuals exposed to extreme hot or cold environments. International Standard, 1st Edn. International.

Patel, A. M. (2007). Lange Instant Access: Orthopedics and Sports Medicine. McGraw-Hill Education. https://doi.org/101036

Porto, C. C. (2017). Exame clínico (8a. ed.). (8a. ed.). Grupo Gen - Guanabara Koogan.

Porto, C. C., & Porto, A. L. (2013). Semiologia médica (7a. ed.). Guanabara Koogan.

Powers, C. M., Witvrouw, E., Davis, I. S., & Crossley, K. M. (2017). Evidence-based framework for a pathomechanical model of patellofemoral pain: 2017 patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester, UK: part 3. British Journal of Sports Medicine, 51(24), 1713–1723. https://doi.org/10.1136/bjsports-2017-098717

Rathleff, M. S., Rathleff, C. R., Olesen, J. L., Rasmussen, S., & Roos, E. M. (2016). Is Knee Pain During Adolescence a Self-limiting Condition? The American Journal of Sports Medicine, 44(5), 1165–1171. https://doi.org/10.1177/0363546515622456

Rolf, C. (2007). the Sports Injuries Handbook. Diagnosis and Management. Primary care (Vol. 19). https://doi.org/10.1007/978-1-59745-414-8

Shanbehzadeh, S., Amiri, A., Pirali, M., Nassadj, G., Yazdi, H. R., & Jamshidi, A. A. (2014). Relative muscle contribution of lower extremity muscles during isokinetic single leg squat in patients following reconstruction of the anterior cruciate ligament. Isokinetics and Exercise Science, 22(4), 343–349. https://doi.org/10.3233/IES-140556

Smith, B. E., Selfe, J., Thacker, D., Hendrick, P., Bateman, M., Moffatt, F., ... 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

Souza, R. B., & Powers, C. M. (2009). Differences in Hip Kinematics, Muscle Strength, and Muscle Activation Between Subjects With and Without Patellofemoral Pain. Journal of Orthopaedic & Sports Physical Therapy, 39(1), 12–19. https://doi.org/10.2519/jospt.2009.2885

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 Musculoskeletal Disorders, 9(1), 36. https://doi.org/10.1186/1471-2474-9-36

Wood, L., Muller, S., & Peat, G. (2011). The epidemiology of patellofemoral disorders in adulthood: a review of routine general practice morbidity recording. Primary Health Care Research & Development, 12(02), 157–164. https://doi.org/10.1017/S1463423610000460