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The applicability of an integrated clinical approach in the management of a patient with chronic aspecific coccygodynia in association with chronic aspecific low back pain: A case report.

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ABSTRACT

INTRODUCTION

Coccygodynia is a musculoskeletal disorder that reduces the quality of life of people in which it occurs. It affects about 1% of the general population with musculoskeletal disorders and it could be due to a multifactorial aetiology. Musculoskeletal disorders in other adjacent areas such as the sacroiliac and/or lumbo-sacral joints may also be associated in the physical examination. The current evidence for the diagnosis of coccygodynia is controversial both for the difficulty in the correlation between pain and structural factors and for the absence of evidence regarding the sensitivity and specificity of the clinical examination. Conservative treatment involves a series of passive interventions to reduce pain. The aim of this paper is to demonstrate how an integrated clinical reasoning could be used in the management of a patient with an aspecific musculoskeletal coccygodynia.

CASE PRESENTATION

The patient reports pain localized in the coccyx for about 3 years with worsening after activities in which there is an increase in load and/or long periods in standing position and/or when getting up from a prolonged sitting/supine position. The patient also refers pain in the lumbar spine. Both coccyx and lumbar pain decrease due to a partial limitation of daily life activities and an abstention from amateur football play. At physical examination the patient presents lumbar hyper-lordosis and hyper-activation of peri-vertebral muscles (static observation) with an alteration in lumbo-pelvic rhythm and during squat (dynamic observation). The palpation of the coccyx and the area adjacent to it causes coccygeal pain and refers to the sacroiliac joints. The functional diagnosis is 'Chronic Aspecific Coccygodynia associated with Chronic Aspecific Low Back Pain'. A central mechanism of pain is prevalent in the maintenance of both musculoskeletal disorders. The reduction of functional and psychological impairments through desensitization, education and gradual increase in load is the tool of the treatment plan for a complete return to activity and participation. After five sessions the patient partially returns to daily life activities without any previously reported pain. At the follow-up at three, six, nine and twelve months there is a complete return to daily life activities and to playing football in the absence of coccygeal and lumbar pain.

CONCLUSIONS

This case report describes the success of pain functional and psychological management in a patient with 'Chronic Aspecific Coccygodynia associated with Chronic Aspecific Low Back Pain'. The use of an integrated clinical approach in patients with coccygodynia could be a practical example to guide physiotherapists performing a functional diagnosis triage and to choose the correct treatment plan for each individual patient. Future studies could consider this decision-making process to validate it when a patient complains pain in the coccyx.

Keywords: clinical reasoning, musculoskeletal manipulations, coccyx, low back pain, rehabilitation, case report.

INTRODUCTION

Coccygodynia is a musculoskeletal disorder that reduces the life quality of people suffering from it, limiting partially or totally the three domains of International Classification of Function (ICF). It affects about 1% of the general population with musculoskeletal disorders [1]. The aetiology is multifactorial. The main cause of coccygodynia is linked to direct trauma, but it can also be idiopathic or linked to indirect trauma [2]. In the clinical history of a patient with coccygodynia, the typical symptom is an intermittent pain in the coccyx which usually worsens in prolonged sitting/standing position, extension of the spine in sitting position and getting up from sitting position, while at the physical examination there is pain on palpation in areas close to the coccyx [3]. Other adjacent areas such as the sacroiliac and lumbo-sacral joints can also be evaluated during the physical examination to check for any concomitant musculoskeletal disorders or neurological syndromes [4]. The comparison of radiography in a sitting and standing position (lateral view) makes possible diagnose coccygodynia and, in association with MRI, exclude any specific coccygodynia or non-musculoskeletal disorder [5]. Currently, the conservative treatment involves a series of interventions able to reduce pain, including intra-rectal manipulations [6][7][8][9]. If conservative treatment fails, a partial or total coccygectomy is necessary [10]. To date coccygodynia, in the evidence based medicine, presents a controversial interpretation in diagnostics: there is difficulty in the correlation between pain and structural factors [11][12][13][14]; there is no evidence regarding the sensitivity and specificity of the clinical examination. Foya et al. reports that coccygodynia is not a diagnosis, but a symptom with many potential causes including acute trauma and local peri-coccygeal pathologies [11]. Therefore, the main aim of this paper is to show how an integrated clinical approach based on a bio-psychosocial model and focused on symptoms characteristics, pain mechanism and preferences/expectations and psychosocial factors of each individual patient [15], could be used in the management of a patient with an aspecific musculoskeletal coccygodynia.

CASE PRESENTATION

PATIENT DEMOGRAPHICS

G.D., caucasian male, 60 years old. He is married with a son and a daughter. He lives with his wife, daughter and mother-in-law. He works as a school bus driver and he manages his own olive grove (pruning and oil production). He plays football at an amateur level (once a week - 5 players). He comes to the physiotherapist without a medical diagnosis and his request is to have a complete return to his daily life activity and to playing football (5 players – once a week) with a partial/total resolution of the musculoskeletal symptoms, mainly in the coccyx.

SIGNS

The patient reports pain localized in the coccyx [Numeric Pain Rating Scale (NPRS) 3/10 at rest - NPRS 5/10 after activity] and altered perception of the position of the coccyx (more horizontal and less vertical). He describes an improvement in coccygeal symptoms at rest and with a reduction in loads, while the worsening is linked to activities in which there is an increased load and/or after long periods in standing position and/or when getting up from a prolonged sitting/supine position. In each of these conditions he refers a stabbing pain in the coccyx with an initial difficulty in standing position and walking.

CLINICAL HISTORY

Sedentary patient, smoker (ten cigarettes a day) and with high BMI (26.7 kg/m2). He has a clinical history of coccygodynia for about three years (NPRS 4/10 at rest – NPRS 6/10 after activity). Before the last six months the patient reported a pain localized in the coccyx that increased during the night (NPRS 8/10), reducing the patient's sleep quality and not allowing him to sleep continuously. The patient also describes frequent shocks to the coccyx which he cannot ascribe to any specific activity/movement, but which occur only when he maintains a position in full load on the coccyx, such as sitting on a chair with feet on the table. The patient also reports a perception of improvement in symptoms after defecation. In the last six months there was a gradual decrease in the coccyx pain due to the partial reduction of loads during daily life activity and to a complete limitation of sport. In addition to coccygodynia, the patient has an asymptomatic lumbar vertebral cleft diagnosed in 1981, to which he associates recurrent low back pain. Furthermore, in 2016, a medical diagnosis of low back pain with a L3- L5 spondylarthrosis without peripheral radiculopathy was detected. For this clinical condition, manual therapy was performed without any success. During his football career (5 - 11 players) he reported a complete anterior cruciate ligament (ACL) injury, a partial medial meniscus tear and the presence of a Baker's cyst at the left knee (1987), resulting in a functional instability of the joint itself. A selective meniscectomy (1991) and arthroscopic reconstruction of the ACL with patellar tendon (1994) were required for the return to sport. Even following the reconstruction surgery, episodes of functional instability continued with consequent knee sprain and rupture of the reconstructed ACL (2005). In the previous six months, low back pain (NPRS 5/10) and left knee pain (NPRS 2/10) occurred after activities with high loads and after playing football (5 players). Following these events, in addition to the pain in the left knee, there were other inflammatory signs/symptoms (swelling and heat), as well as stinging pain in load not related to any specific movement (NPRS 8/10).

FUNCTIONAL DIAGNOSIS

DIAGNOSTIC TESTS

At static observation in standing position, the patient presents lumbar hyper-lordosis, while at dynamic observation during the lumbo-pelvic rhythm there are two aberrant movement such as the Gower's sign and the reversal of lumbo-pelvic rhythm and poor lumbo-pelvic motor control [16]. Furthermore, in the squat there is poor pelvic motor-control. Upon visual inspection of the skin in the lumbar and coccygeal area, no alteration is detected. Observation and palpation of peri-vertebral muscles show muscle hyper-activation. The external palpation of the coccyx and of the area adjacent to it 4 causes pain that increases in the proximal part of the coccyx and refers to the sacroiliac joints. Observation and palpation are performed with the patient in prone position. During the physical examination, the tests of the Laslett's battery [17] are performed and only sacral thrust reproduces the patient's typical pain. Even if the result of the Laslett's battery is negative, specific sacroiliac symptom modification techniques are still performed due to the proximity to the lumbar and coccygeal structures 4: posterior rotation of the ileum/nutation of the sacrum in unload; anterior rotation of the ileum/contro-nutation of the sacrum in unload; posterior rotation of the ileum/nutation of the sacrum with extension in unload; anterior rotation of the ileum/contro-nutation of the sacrum with extension in unload; posterior rotation of the ileum/nutation of the sacrum with flexion in unload; anterior rotation of the ileum/contro-nutation of the sacrum with flexion in unload; posterior rotation of the ileum/nutation of the sacrum with extension in load; anterior rotation of the ileum/contro-nutation of the sacrum with extension in load; posterior rotation of the ileum/nutation of the sacrum with flexion in load; anterior rotation of the ileum/contro-nutation of the sacrum with flexion in load [18]. Two symptom modifying techniques result positive, which are the posterior rotation of the ileum/nutation of the sacrum with flexion in unload and the posterior rotation of the ileum/nutation of the sacrum with flexion in load, while the symptom modifying techniques with extension reproduce pain at the lumbar level (NPRS 2/10).

BARRIERS TO THE DIAGNOSTIC/THERAPEUTIC PROCESS

The diagnostic/therapeutic process took place at the patient's home.

DIAGNOSTIC REASONING

In the absence of 'red flags', the patient's clinical history is consistent with a musculoskeletal dysfunction. Furthermore, the identification of aggravating and alleviating factors, in association with uninterrupted sleep and the absence of organ-specific symptoms in the last 6 months, make low the risk of 'referral'. For the functional diagnosis of 'chronic aspecific coccygodynia associated with chronic aspecific low back pain', following the anamnesis, a physical examination is

performed for differential diagnosis of 'pelvic girdle pain'. Chronic aspecific low back pain with impaired movement control was highlighted following the identification of one subjective clinical indicator in the anamnestic phase (frequent relapses without any remission) and the presence of two objective clinical indicators, which are aberrant movements and poor lumbo-pelvic control 16. The 'pattern' movement control alteration, according to O'Sullivan at al.'s classification, is 'active extension' [19][20]. Furthermore, pain is driven by a mechanism of 'maladaptive motor control pattern' which, specifically, is defined as 'control impairment' [21].

PROGNOSTIC VARIABLES

The anamnesis shows the presence of 'yellow flags' relating to the functions of the body, such as patient's beliefs and expectations regarding the healing process and the return to sport (pain is not manageable and rest is the best solution) and environmental factors (experience of previous therapeutic failures and previous passive treatment modalities). The pain mechanism is mixed with nociplastic prevalence. A higher percentage of pain is related to the load/load capacity model 22. The patient presents inadequate 'coping' with 'boosting of movement' behavior [23]. Lumbar and left knee symptoms are further negative prognostic factors for returning to sport.

THERAPEUTIC INTERVENTION

THREATMENT PLAN

Sacroiliac symptom modification techniques, patient's education to nociceptive/central pain and a gradual/progressive increase in loads are the strategies for returning to high-load daily activity and sport with absence of musculoskeletal pain. The duration of the six sessions was one hour each one.

SESSION 1 (t_0)

The treatment begins on 11.08.2019 with the 2 sacroiliac symptom modification techniques that result positive at the physical examination (t_0), which are posterior rotation of the ileum/nutation with flexion in unload (figure 1) and the posterior rotation of the ileum/nutation of the sacrum with flexion in load (figure 2). 3 series of 10 repetitions are performed in order to modify the patient's pain symptom with preliminary loading techniques. At the end of the session the patient is educated on the mechanism of nociceptive/central pain and on the local and general load/load capacity model.

Figure 1: posterior rotation of the ileum/nutation of the sacrum in unload.

Figure 2: posterior rotation of the ileum/nutation of the sacrum with flexion in load.

He is also educated to perform 1 exercise from supine (3 sets of 10 repetitions - 3 times a week) (figure 3) to recover the sense of position of the lumbar spine. The exercise must be associated with breathing with exhalation during pelvic retroversion and inhalation during pelvic anteversion and in the absence of lumbar pain. It is also advised to avoid high-load activities at home or playing football in the following days.

Figure 3. Anterior and posterior pelvic tilt in supine position.

The patient, imagining bringing the pubis towards the navel and move the navel away from the pubis, performs a posterior (figure 3) and anterior pelvic tilt respectively. Maintain the positions for 10 seconds. The patient is asked to exhale during posterior pelvic tilt and to inhale during anterior pelvic tilt.

Session 2 (t_1)

The focus of the second session (25.08.2019) is a reduction of the discomfort at the coccygeal level (NPRS 0/10) and the sensation of alteration of the position of the same (+ horizontal and - vertical), through 3 sacroiliac symptom modification techniques which result positive at the intra-session follow-up, represented by the two techniques performed in session 1 (t_0) and the posterior rotation of the ileum/nutation of the sacrum in 'semi-squat' (figure 4). 3 series of 10 repetitions are performed for each technique. This last technique allows a greater axial load in a patient whose pain perception has improved. At the end of the session the patient is educated on the mechanism of nociceptive/central pain and on the local and general load/load capacity model. Given the patient's reduced 'compliance' with the execution of the exercises at home, the patient is advised only to run lightly on non-accidental terrain (15 minutes - 3 times a week) and to avoid high-load activities at home or playing football in following days.

Figure 4: posterior rotation of the ileum/nutation of the sacrum with flexion in semi-squat.

Session 3 (t_2)

The third session (29.08.2019) focuses on the reduction of lumbar pain present during the sacroiliac symptom modification techniques in extension to t_0 and t_1 (NPRS 2/10) and following high-load daily activities and playing football (NPRS 5/10 after activity). The discomfort and the sensation of alteration of the position of the coccyx at rest (+ horizontal and - vertical) persist. Oscillatory techniques of I-II degree are performed in both regional (L1-L5) and segmental (L2) postero-anterior direction of the spinous processes (figure 5) and prone traction techniques (I-II degree) (figure 6). During the II degree oscillatory technique in the posterior-anterior direction to the L2 segment, the patient refers pain at the level of the sacroiliac joints.

Figure 5: oscillatory technique in postero-anterior direction.

Figure 6. Traction in prone lying.

At the end of the session, the patient is educated on the mechanism of nociceptive/central pain, in the general and local load/load capacity, and in the execution of 4 exercises to recover the sense of position of the lumbar spine, to be performed in association with breathing with exhalation during pelvic retroversion and inhalation during pelvic anteversion and in the absence of lumbar pain (3 sets of 10 repetitions for each exercise - 3 times a week). The execution takes place supine (figure 3), prone with support on the 4 limbs (figure 7), seated with upper limbs resting on the knees (figure 8) and in an upright position with fixed support of the upper limbs to a surface in line with shoulder height (figure 9). It is recommended to continue with light running on non-accidental terrain (15 minutes - 3 times a week) and to avoid high-load activities at home or playing football in the following days.

Figure 7: anterior and posterior pelvic tilt in four-point kneeling hand position.

The patient, imagining bringing the pubis towards the navel and move the navel away from the pubis, performs a posterior pelvic tilt (figure 7) and anterior respectively. Maintain the positions for 10 seconds. The patient is asked to exhale during posterior pelvic tilt and to inhale during anterior pelvic tilt.

Figure 8: anterior and posterior pelvic tilt in sitting position.

The patient, imagining bringing the pubis towards the navel and move the navel away from the pubis, performs a posterior and anterior pelvic tilt (figure 8) respectively. Maintain the positions for 10 seconds. The patient is asked to exhale during posterior pelvic tilt and to inhale during anterior pelvic tilt.

Figure 9. Anterior and posterior pelvic tilt in standing position.

The patient, imagining bringing the pubis towards the navel and move the navel away from the pubis, performs a posterior (figure 9) and anterior pelvic tilt respectively. Maintain the positions for 10 seconds. The patient is asked to exhale during posterior pelvic tilt and to inhale during anterior pelvic tilt.

Session 4 (t_3)

The focus of the fourth session (01.09.2019) is the reduction of lumbar pain found at the intra-session evaluation (NPRS 1/10) and during daily activities with high load (NPRS 3/10), even if coccyx discomfort persists immediately after high-load activities. Oscillatory techniques of III degree are performed in both regional (L1-L5) and segmental (L2) postero-anterior direction on the spinous processes (figure 5) and prone traction techniques (III degree) (figure 6). At the end of the session the patient is educated on the mechanism of nociceptive/central pain, on the local and general load/load capacity, and on the execution of 3 exercises (3 series of 10 repetitions for each exercise - 3 times a week) for the control of the lumbar spine independently of the other body areas. The execution takes place supine (figure 10), prone resting on the 4 limbs (figure 11) and standing upright against the wall (figure 12). If the patient benefits from it, the exercises of the previous session (t_2) can also be performed (figures 3, 7, 8 and 9). It is also recommended to continue with light running on non-accidental terrain (15 minutes - 3 times a week) and to avoid from high-load activities at home or playing football in the following days.

Figure 10: bridge with posterior pelvic tilt in supine position.

The patient, imagining keeping the pubis towards the navel, first performs a posterior pelvic tilt and then pushes the pelvis upwards by contracting the buttocks.

The patient moves the pelvis backwards (figure 11) and forwards, checking the neutral position of the lumbar spine.

Figure 11: anterior and posterior rocking pelvis in four-point kneeling hand position.

Figure 12. Wall semi-squat with posterior pelvic tilt.

The patient, imagining bringing the pubis towards the navel, first performs a posterior pelvic tilt and then, leaning against the wall, performs a semi-squat.

Session 5 (t_4)

The fifth session (05.09.2019) focuses on the reduction of lower back pain found at the intra-session assessment (NPRS 1/10) and during high-load daily activities (NPRS 4/10), as well as on increasing workloads respecting the symptoms. Following a variation in the localization of lumbar pain, I-II degree oscillatory technique is performed in rotation on the transverse process

of L3 (figure 13) and the following sacroiliac symptom modification techniques with a weighted belt of 4 kg (3 series 10 repetitions): posterior rotation of the ileum/nutation with flexion in unload (figure 1), posterior rotation of the ileum/nutation of the sacrum with flexion in load (figure 2) and posterior rotation of the ileum/nutation of the sacrum in 'semi-squat' (figure 4).

Figure 13: oscillatory technique in rotation.

In addition, 3 exercises are performed, including 1 on the sense of position of the lumbar spine (3 sets of 10 repetitions) from the supine (figure 3) and 2 exercises to control the lumbar spine in functional movements, such as lumbo-pelvic rhythm (figure 14) and 'sit-to-stand' (figure 15). Such exercises are performed with an overload of 4 kg. At the end of the session the patient is educated on the mechanism of nociceptive/central pain, on the local and general load/load capacity model, and on the execution of the 2 previous exercises (figures 14 and 15) (3 series of 10 repetitions for each exercise - every day). With the same timing it is also recommended to continue with the execution of 3 of the 4 exercises of the previous sessions (figures 3, 10 and 11), to continue with the light run (15 minutes -3 times a week) and to avoid playing football and, at least partially, high-load activities at home in the following days. The exercise in figure 12 is not recommended as the patient reports pain in the left knee while performing the same.

Figure 14: the patient first bends forward keeping the lower limbs straight and then returns from the flexion. The patient is asked to perform the flexion movement first with the lumbar spine (posterior pelvic tilt) and then with the hips, while for the return movement from flexion the lumbo-pelvic rhythm is opposite. The overload is 4 kg.

Figure 14: lumbo-pelvic rhythm with overload.

Figure 15: semi-squat with overload.

The patient performs the semi-squat, maintaining control of the lumbar spine in anterior pelvic tilt. The overload is 4 kg.

Session 6 (t_5)

The last session is mainly based on physical examination (07.09.2019). At the end of the examination, the patient is educated in the mechanism of nociceptive/central pain, in the local and general load/local capacity model, and the learning in the execution of exercises is verified (figures 3, 10, 11, 14 and 15) (3 sets of 10 repetitions for each exercise - every day). It is also recommended to continue with light running (15 minutes - 3 times a week), to reintroduce high-load activities at home in the following days and to gradually return to playing football.

Follow-up and outcomes

FOLLOW-UP

Follow-up are carried out in all therapeutic sessions following the physical exam of the first session(t_0). Physical exam is carried out pre- and post- each therapy session. Follow-up at 3 months (t_6), 6 (t_7), 9 (t_8) and 12 (t_9) months are performed by a phone interview. At t_1 the following symptom modifying techniques for the sacroiliac joint are performed: posterior rotation of the ileum/nutation of the sacrum with flexion in unload; posterior rotation of the ileum/nutation of the sacrum with flexion in load; posterior rotation of the ileum/nutation of the sacrum in semi-squat; posterior rotation of the ileum/nutation of the sacrum in semi-squat. Three techniques modify in positive the coccyx pain of the patient, which are the posterior rotation of the ileum/nutation of the sacrum with flexion in unload, posterior rotation of the ileum/nutation of the sacrum with flexion in load and posterior rotation of the ileum/nutation of the sacrum in semi-squat, while the symptom modifying techniques with extension reproduce the lumbar pain (NPRS 2/10). For a possible regional interdependence between coccyx and low back pain and for a better diagnostic framework a physical examination is performed on the lumbar spine. During the physical examination, active mobility of the lumbar spine, including the unidirectional flexion test and the unidirectional extension test, is provided. The patient reports pain only in extension (NPRS 2/10). On the repeated active extension test there is no change in lumbar pain. The lumbo-pelvic rhythm is altered with only hip flexion. Lumbar spine provocation tests are also performed, such as traction test, compression test and regional and segmental springing test. Traction test, regional and segmental springing test result positive. The maximum lumbar pain perceived by the patient is localized in the segmental springing of the L2 spinous (NPRS 2/10). At t_3 and t_4 the same physical examination of the lumbar spine is performed. The same test of the third session (t_2) is positive, however the maximum lumbar pain perceived by the patient is NPRS 1/10. Unlike the previous evaluations, at t_4 the pain is localized on the transverse process of L3 with irradiation in the right gluteal region. Furthermore, in the post-session of t_4 the patient presents an adequate lumbo-pelvic rhythm.

OUTCOMES

Primary outcome measures are coccygeal and lumbar NPRS and return to activities/participation. Secondary outcomes are active mobility of the lumbar spine in flexion and extension, the 'Tampa scale of kinesiophobia'-11 (TSK-11) and the 'pain Catastrophizing Scale' (PCS). Patient-reported outcome measures are NPRS, TSK-11 and PCS. Previous studies have documented the intra and inter-examiner reproducibility, validity and 'Minimal Clinically Important Difference' (MCID) of NPRS (2 points) [24]. There are also studies in the literature to validate the Italian version of TSK 25 and PCS [26]. For the TSK, however, the study refers to the questionnaire with 13 'items' [25], while for the PCS instead of the MCID value, there is the 'Minimum Detectable Change' (MDC) which is 10.45 points [26].

After the last session (t_5), the MCID values were satisfactory for both coccygeal and low back pain. Specifically, coccygeal pain is significantly reduced after the first session (t_0), while lumbar pain is significantly reduced at the end of the third session (t_2). After the recurrence of coccygeal pain and the increase in lumbar pain between the fourth and the fifth session (t_3- t_4) a clinically significant reduction of coccygeal pain without treatment is detected, there is a clinically significant reduction in coccygeal pain with self-exercise at home before the start of the fifth session (t_4), while a clinically significant reduction in low back pain occurs at the end of the fifth session (t_4). The timelines of coccyx pain (figure 16) and low back pain (figure 17) from six months pre-treatment to twelve months follow-up are shown below respectively. Table 1 and 2 reports the variations in TSK-11 value at t_0 and t_5 respectively. Table 3 and 4 reports the variations in PCS value at t_0 and t_5 respectively.

Non-patient reported outcome measures are the active mobility of the lumbar spine, the perception of the coccyx and the return of activity/participation. Active mobility is measured in the third session (t_2). At t_3 there is an improvement in active extension, while at t_4 there is an increase in flexion mobility with correct lumbo-pelvic rhythm. At t_5 there is a further improvement in flexion mobility. With regard to sensitivity of the area at t_2 the patient reports absence of alterations in perception at the coccygeal level and at t_3 absence of discomfort to the same. The altered perception of the area is no longer reported in subsequent sessions and at t_9, while the discomfort occurs occasionally for a short period of time. The last session (t_5) detects a reduction in lumbar hyper-lordosis on static inspection in standing position, while on dynamic inspection no alteration of the lumbo-pelvic rhythm is reported. No alteration and/or pain is detected upon visual inspection of the skin and palpation of the peri-vertebral muscles near the lumbar spine and coccyx. Again at t_5, there is no more lumbar pain during active extension and provocation test. The patient reports discomfort in the segmental springing of L2. About activity and participation at t_5 the patient only partially resumes daily high-load activity without any musculoskeletal pain, even in the following days. Full return to high-load daily activity and to playing football occurs at 3 months (t_6). Table 5 reports a summary of the changes in the main outcome measures during the physical examination in the different sessions and during the phone interview.

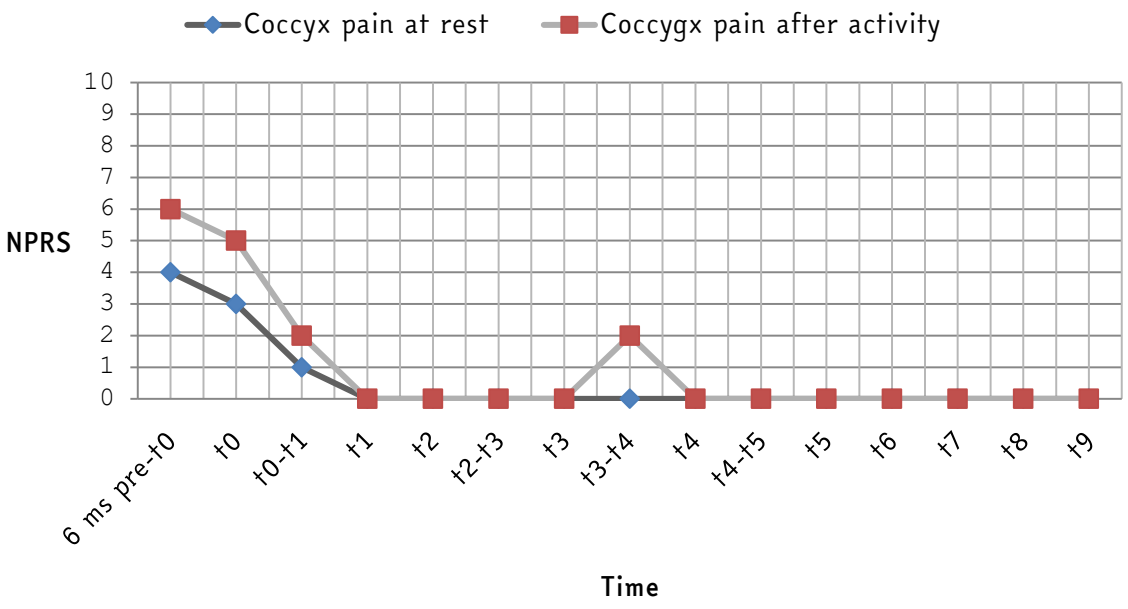

Figure 16: timeline of coccyx pain. Key: NPRS, Numeric Pain Rating Scale; ms, months; t_0, 1st treatment session; t_1, 2nd treatment session; t_2, 3rd treatment session; t_3, 4th treatment session; t_4, 5th treatment session; t_5, 6th treatment session; t_6, 3 months follow-up; t_7, 6 months follow-up; t_8, 9 months follow-up; t_9, 12 months follow-up.

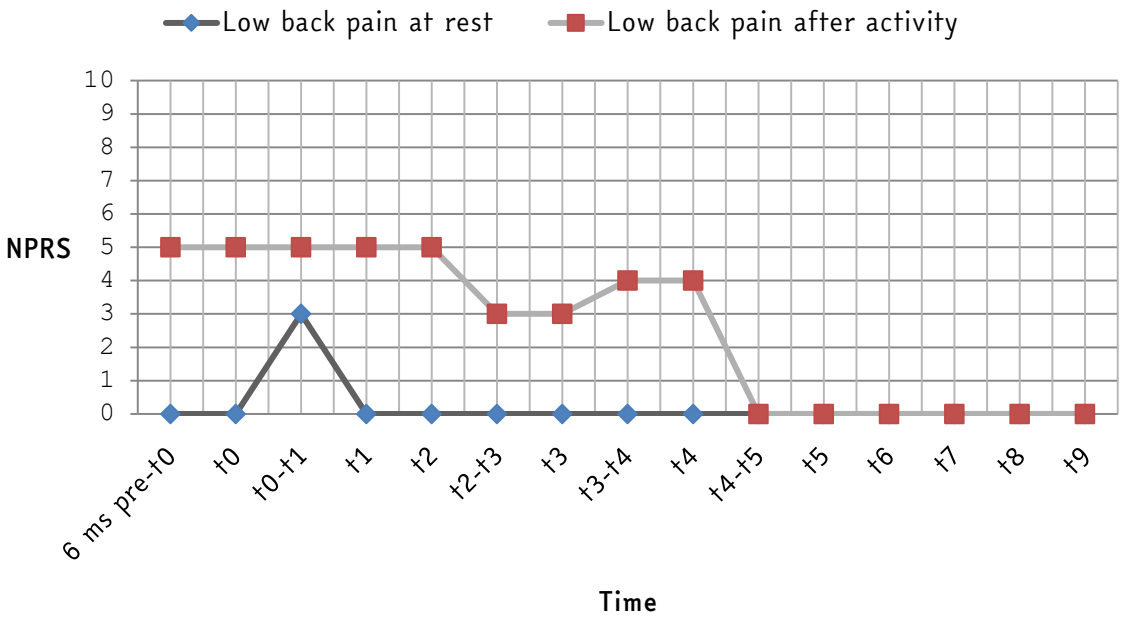

Figure 17: timeline of low back pain. Key: NPRS, Numeric Pain Rating Scale; ms, months; t_0, 1st treatment session; t_1, 2nd treatment session; t_2, 3rd treatment session; t_3, 4th treatment session; t_4, 5th treatment session; t_5, 6th treatment session; t_6, 3 months follow-up; t_7, 6 months follow-up; t_8, 9 months follow-up; t_9, 12 months follow-up

'TAMPA SCALE OF KINESIOPHOBIA'-11 (TSK-11) AT t_0					
n.	**'Item'**	**CD**	**PD**	**PA**	**CA**
1	I am afraid that I might injure myself if I exercise	1	2	3	4
2	If I were to try to overcome it, my pain would increase	1	2	3	4
3	My body is telling me I have something dangerously wrong	1	2	3	4
5	People are not taking my medical condition seriously enough	1	2	3	4
6	My accident has put my body at risk for the rest of my life	1	2	3	4
7	Pain always means I have injured my body	1	2	3	4
10	Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from worsening	1	2	3	4
11	I would not have this much pain if there were not something potentially dangerous going on in my body	1	2	3	4
13	Pain lets me know when to stop exercising so that I do not injure myself	1	2	3	4
15	I can not do all the things normal people do because it is too easy for me to get injured	1	2	3	4
17	No one should have to exercise when he=she is in pain	1	2	3	4
Total value = 35/44					
Activity avoidance (1, 2, 10, 15, 17) = 14/20					
Somatic focus (3, 5, 6, 7, 11, 13) = 21/24					

Table 1: 'Tampa Scale of Kinesiophobia'-11 (TSK-11) at t_0. Key: n., number; t_0, session 1; CD, 'Complete Disagreement'; PD, 'Partial Disagreement'; PA, 'Partial Agreement'; CA, 'Complete Agreement'.

'TAMPA SCALE OF KINESIOPHOBIA'-11 (TSK-11) AT t_5					
n.	**'Item'**	**CD**	**PD**	**PA**	**CA**
1	I am afraid that I might injure myself if I exercise	1	2	3	4
2	If I were to try to overcome it, my pain would increase	1	2	3	4
3	My body is telling me I have something dangerously wrong	1	2	3	4
5	People are not taking my medical condition seriously enough	1	2	3	4
6	My accident has put my body at risk for the rest of my life	1	2	3	4
7	Pain always means I have injured my body	1	2	3	4
10	Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from worsening	1	2	3	4
11	I would not have this much pain if there were not something potentially dangerous going on in my body	1	2	3	4
13	Pain lets me know when to stop exercising so that I do not injure myself	1	2	3	4
15	I cannot do all the things normal people do because it is too easy for me to get injured	1	2	3	4
17	No one should have to exercise when he=she is in pain	1	2	3	4
Total value = 31/44 **Activity avoidance (1, 2, 10, 15, 17) = 14/20** **Somatic focus (3, 5, 6, 7, 11, 13) = 17/24**					

Table 2: 'Tampa Scale of Kinesiophobia'-11 (TSK-11) at t_5. Key: n., number; t_5, session 6; CD, 'Complete Disagreement'; PD, 'Partial Disagreement'; PA, 'Partial Agreement'; CA, 'Complete Agreement'.

'PAIN CATASTROPHIZING SCALE' (PCS) AT t_0.						
n.	**'Item'** When I'm in pain…	**NA**	**SD**	**MD**	**GD**	**AT**
1	I worry all the time about whether the pain will end	0	1	2	3	4
2	I feel I can't go on	0	1	2	3	4
3	It's terrible and I think it's never going to get any better	0	1	2	3	4
4	It's awful and I feel that it overwhelms me	0	1	2	3	4
5	I feel I can't stand it anymore	0	1	2	3	4
6	I become afraid that the pain will get worse	0	1	2	3	4
7	I keep thinking of other painful events	0	1	2	3	4
8	I anxiously want the pain to go away	0	1	2	3	4
9	I can't seem to keep it out of my mind	0	1	2	3	4
10	I keep thinking about how much it hurts	0	1	2	3	4
11	I keep thinking about how badly I want the pain stop	0	1	2	3	4
12	There's nothing I can do to reduce the intensity of the pain	0	1	2	3	4
13	I wonder whether something serious may happen	0	1	2	3	4
Total value = 20/52 **Helplessness (2, 3, 4, 5, 6, 12) = 8/24** **Rumination (1, 8, 9, 10, 11) = 9/20** **Magnification (7, 13) = 3/8**						

Table 3: 'Pain Catastrophizing Scale' (PCS) at t_0. Key: n., number; NA, 'Not at All'; SD, 'to a Slight Degree'; MD, 'to a Moderate Degree'; GD, 'to a Great Degree'; AT, 'All the Time'

'PAIN CATASTROPHIZING SCALE' (PCS) AT t_5.						
n.	**'Item'** When I'm in pain...	**NA**	**SD**	**MD**	**GD**	**AT**
1	I worry all the time about whether the pain will end	0	1	2	3	4
2	I feel I can't go on	0	1	2	3	4
3	It's terrible and I think it's never going to get any better	0	1	2	3	4
4	It's awful and I feel that it overwhelms me	0	1	2	3	4
5	I feel I can't stand it anymore	0	1	2	3	4
6	I become afraid that the pain will get worse	0	1	2	3	4
7	I keep thinking of other painful events	0	1	2	3	4
8	I anxiously want the pain to go away	0	1	2	3	4
9	I can't seem to keep it out of my mind	0	1	2	3	4
10	I keep thinking about how much it hurts	0	1	2	3	4
11	I keep thinking about how badly I want the pain stop	0	1	2	3	4
12	There's nothing I can do to reduce the intensity of the pain	0	1	2	3	4
13	I wonder whether something serious may happen	0	1	2	3	4
Total value = 4/52 **Helplessness (2, 3, 4, 5, 6, 12) = 2/24** **Rumination (1, 8, 9, 10, 11) = 1/20** **Magnification (7, 13) = 1/8**						

Table 4: 'Pain Catastrophizing Scale' (PCS) a t_5. Key: n., number; NA, 'Not at All'; SD, 'to a Slight Degree'; MD, 'to a Moderate Degree'; GD, 'to a Great Degree'; AT, 'All the Time'

PATIENT AND NON-PATIENT REPORTED OUTCOME MEASURES AT BASELINE AND FOLLOW-UP						
Session	NPRS coccyx	NPRS lumbar	Lumbar flexion	Lumbar extension	TSK-11	PCS
t_0	5/10	2/10	-	-	35/44	20/52
post-t_0	0/10 *	2/10	-	-	-	-
t_1	0/10	2/10	-	-	-	-
post-t_1	0/10	2/10	-	-	-	-
t_2	0/10	2/10	+5 cm	+137 cm	-	-
post-t_2	0/10	0/10 *	+5 cm	+137 cm	-	-
t_3	0/10	1/10	+6 cm	+135 cm	-	-
post-t_3	0/10	1/10	+6 cm	+135 cm	-	-
t_4	0/10	1/10	+6 cm	+135 cm	-	-
post-t_4	0/10	0/10	+2 cm	+135 cm	-	-
t_5	0/10	0/10	-1 cm	+135 cm	31/44	4/52
post-t_5	0/10	0/10	-1 cm	+135 cm	-	-
t_6	0/10	0/10	-	-	-	-
t_7	0/10	0/10	-	-	-	-
t_8	0/10	0/10	-	-	-	-
t_9	0/10	0/10	-	-	-	-

*Table 5: patient and non-patient reported outcome measures at baseline and follow-up. Key: NPRS, 'Numeric Pain Rating Scale'; TSK-11, 'Tampa scale of kinesiophobia'-11; PCS, 'Pain Catastrophizing Scale'; t_0, session 1; t_1, session 2; t_2, session 3; t_3, session 4; t_4, session 5; t_5, session 6; t_6, phone interview 1; t_7, phone interview 2; t_8, phone interview 3; t_9, phone interview 4; -, not evaluated; *, 'Minimal Clinical Importance Difference' (MCID).*

The flexion and extension of the lumbar spine are assessed with a tape measure. For flexion, the distance of the apex of the third finger of the right/left hand from the support base is evaluated (+ if the third finger stops before the support base and - if the third finger goes beyond the support base). For the extension, the distance of C7 from the support base is evaluated. The compliance and tolerability of the intervention were based on what the patient reported and on the increase in workloads at each individual session.

With regard to the single session: t_0- t_1, the patient did not perform the exercise at home (figure 3) and did not comply with the instructions to refrain from high loads and from playing football. The patient only partially avoids high-load daily activities and playing football (5 players – duration 30'); t_1- t_2, the patient performs jogging respecting the set times, but practices

the activity on accidental ground. The patient only partially avoids high-load daily activities; t_2-t_3, t_3- t_4 and t_4- t_5, the patient performs independently at home what is requested according to the set times, but only partially avoids high-load daily activity; t_3- t_4, the patient performs an optional home exercise (figure 3); t_4- t_5, the patient hardly tolerate the exercise represented in figure 12; t_5-t_6, the patient performs independently at home what is required according to the set times and only partially performs the high-load daily activities. There were 2 adverse events, according to the classification reported by Carnes et al. [27]:one 'moderate' to the lumbar spine (NPRS 4/10 in movement), after the fourth treatment session (t_3) and a 'mild' one to the coccyx (NPRS 2/10 at rest), after performing the exercises at home between t_3 and t_4.

DISCUSSION AND CONCLUSIONS

THE STRENGHTS AND LIMITATION OF MANAGEMENT OF THIS CASE

An integrated clinical approach based on bio-psychosocial model and focused on symptoms characteristics, pain mechanism and preferences/expectations and psychosocial factors of each individual patient [15] seems to show the possibility of a safe management of a patient with an aspecific musculoskeletal coccygodynia. It should also be noted that the case report presents numerous negative prognostic factors. For the physiotherapy diagnosis of chronic non-specific coccygodynia there is an absence of imaging for the medical diagnosis of specific coccygodynia and for the differential diagnosis of non-musculoskeletal pathology. Only the medical history and physical examination are used for the exclusion of any red flags and for the physiotherapy diagnosis. Treatment of coccygeal pain is based partly on the biomechanical model (sacroiliac joint proximity) and partly on the concept of central pain sensitization [28]. With regard to the diagnostic evaluation process of chronic aspecific low back pain only the patient's medical history and static and dynamic inspection are taken into consideration during the initial evaluation, without performing active mobility test and provocation test of the lumbar spine at baseline (t_0). These tests are performed only in the third session (t_2). In addition, an evaluation with passive test (joint play) and through the battery of 'Movement Control Dysfunction' (MCD) test [29][30], is not performed to be more selective in the exercises proposed by O'Sullivan 21 and Lumajoski et al. [31] or the 'Two Point Discrimination' (TPD) test for the assessment of alterations in peripheral afferents [32]. It should also be noted that hyper-lordosis and muscle hyper-activation, performed on static and dynamic inspection, were visually assessed but not measured, while the alteration of the lumbo-pelvic rhythm is a 'test' with poor psychometric properties. With regard to the treatment path, education in the mechanism of nociceptive / nociplastic pain and the load / load capacity model took place through a theoretical explanation with practical examples of events from the patient's daily life.

During the entire rehabilitation process, the patient continued, even if partially, in high-load activities at home. There is also a poor continuity of care given by the distance of the treatment sessions and the need to prolong the treatment. This is in order to objectively evaluate what is reported in the anamnesis at the level of the left knee and possibly treat the chronic problem

encountered and, secondly, given the characteristics of the patient, verify the effectiveness in medium-long term of the complete return to activities of daily living and to playing football. The phone interview at 3, 6, 9 and 12 months (t_6 – t_9) may, in fact, present critical issues with respect to the "face to face" interview. The outcome measures taken into consideration represent only a small part of the bio-psycho-social sphere according to the ICF classification. Furthermore, the patient presents a clinically significant reduction in coccygeal and lumbar pain symptoms even before the initial physiotherapy evaluation (t_0). Regarding the improvement of the active movement in flexion and extension of the lumbar spine, there was no evaluation of the movement only at the level of the spine, but compensation of the hip was allowed. An element not objectively evaluated is the presence or absence of central sensitization of the patient, as well as the effectiveness of education in nociceptive/nociplastic pain and the load/load capacity model. Then there are the intrinsic limits of the reference guideline for the drafting according to EBM of the following 'case report' [33].

THE RELEVANT MEDICAL LITERATURES

Previous studies demonstrate the efficacy of non-invasive manual therapy and exercise in the treatment of patients with aspecific low back pain [32], however there is no evidence regarding coccygeal pain. The model proposed in the article by Bialosky et al. [28] could be a starting point for understanding the improvement of the patient's symptoms at the coccygeal level.

THE RATIONAL FOR CONCLUSIONS

Although this case report demonstrates an improvement in all outcome measures, only pain in coccyx and in lumbar spine is clinically significant. The improvement in active flexion and extension movement of the lumbar spine is not related to a restriction of movement, but to a correction of the movement pattern. Then there is the possible absence of a cause-effect relationship and/or possible relationship between chronic nonspecific coccygodynia and chronic nonspecific low back pain. Regarding the first point, it is possible, even if unlikely given the duration of the patient's symptoms, that spontaneous recovery would have occurred in the absence of treatment. Due to the relationship between the two musculoskeletal dysfunctions found, it is possible that the coccygeal pain was partly related to the symptoms found in the lumbar spine. Although the symptom modifying techniques for the sacro-iliac led to a complete resolution of the coccygeal pain (t_1), the treatment with manual therapy and exercise (t_2, t_3) resulted in a resolution of the altered perception of the position of the coccyx (+ vertical and – horizontal) (t_2) and discomfort to the same (t_3). Furthermore, between t_0- t_1 the reappearance of coccygeal pain (NPRS 1/10 in movement) seems to correlate with the reappearance of pain at rest (NPRS 3/10) after a football match (5 players – duration 30') and high-load daily activity. Also between t_3- t_4 this correlation seems to be present (NPRS coccyx 2/10 in movement and NPRS lumbar spine 4/10 in movement), however, coccygeal pain occurs following self-managed exercises at home and resolves spontaneously after about 2 hours, while the pain in the lumbar spine occurs

following treatment in the fourth session (t_3) and persists until the evaluation in the fifth session (t_4).

PRACTICAL IMPLICATIONS

This case report describes the success in functional pain management in a patient with chronic aspecific coccygodynia associated with chronic aspecific low back pain. The use of clinical reasoning that is based on the combination of symptom modification techniques, education and adequate loading strategies, could be a first practical example of how the bio-psychosocial model [15] can be implemented, both for diagnosis and for treatment of an aspecific musculoskeletal coccygodynia. In addition, a sub-classification, based on the mechanism underlying the musculoskeletal dysfunction, is necessary for a better management of the disorder [21]. This sub-classification has also been taken into consideration in other chronic musculoskeletal dysfunctions [35][36].

PATIENT PERSPECTIVE

The patient during the anamnestic process (t_0) reports to be not fully convinced on the possibility of returning to play football (5 players) without feeling any coccygeal, lumbar and/or left knee pain during and after the match. The coccygeal and lumbar pain are contextualized by referring them to a biomechanical model of load/load capacity that is constantly reinforced by the anatomical data of vertebral cleft, even if asymptomatic. The anatomical data represents a weak area for the patient to be protected by avoiding excessive loads: 'I cannot strain my back because, otherwise, the weak part of the vertebral cleft hurts'. Also, for the left knee the patient reports a chronicity of the problem in the six months preceding the reduction of heavy loads and the limitation of participation with consequent fear of movement and load. The patient is worried about the lack of cartilage at the medial level which causes him a stinging pain that cannot be correlated with any gesture/specific movement (NPRS 8/10): 'If previously when I strained the knee I had only a sensation of instability or possibly some sprains, now the condition has become chronic'. The patient, in addition to referring his musculoskeletal condition to his clinical history, correlates it with advanced age. The patient's behaviour seems to show resignation, however, the tendency to fight this condition autonomously without referring to a healthcare professional remains. This behaviour is partly justified by the experience lived with previous health professionals and by the ineffectiveness of the therapies adopted both at the lumbar level and at the knee level.

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