Chronic Pain Due to Pelvis Fracture and Perceptive Rehabilitation

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Abstract: Recently, somatosensory rehabilitation is knowing a growing interest in chronic pain condition. In fact, new evidences have associated an impaired lumbopelvic control with a decreased tactile acuity, generating and sustaining chronic low back pain mechanisms. Consequently, an adequate tactile rehabilitation, entailing a discrimination training with a stimulation tasks, seems to be effective on pain, reducing lumbopelvic impairments.

Also the use of perceptual surfaces can be effective on back pain, favouring a tactile and proprioceptive sensory stimulation on the trunk and improving the postural control through a body midline realignment.

The aim of this manuscript was to describe the preliminary evidences on two cases of chronic pain due to pelvis fracture treated with the perceptive surfaces. Furthermore, we have tried to clarify the mechanisms involved in chronic back pain and the effect of a somatosensory rehabilitation. Finally, it was analyzed the role of craniocaudal body midline with the gravitational vertical axis in the setting of correct alignment for improving postural control in these conditions.

Keywords: Perceptive surfaces, proprioception, tactile rehabilitation, polytrauma.

INTRODUCTION

Pelvis is an anatomical district involved in fractures due to high-energy forces such as a motor vehicle accident, cycling accidents, or a fall from significant height, even if they are present in the falls of the elderly [1].

Patients with a pelvis fracture may suffer posterior pain and, subsequently, chronic low back pain. In fact, it is reported as a common symptom with reported rates varying from around 20 to 66% [2] and until 90% in the patients involved in severe pelvis trauma [3].

Long-term functional outcomes in these patients are poor, in particular when trauma is associated with sacral dislocation, fragment displacement and associated injuries. It implies a significant disability with severe reduction in physical, social, and mental aspects of health, still present one year after the injury [3,4].

Reducing low back pain (LBP) is mandatory in these patients. A large number of therapies have been proposed for the treatment of LBP. Physical rehabilitative exercises are one of the best options for reducing pain and improving functions [5]. Unfortunately rehabilitation after a pelvis fracture is not well described in scientifc literature, lacking completely of a re-education of the back pain sequela and body sense perception.

Hence, the development of specific rehabilitative techniques to improve disability and quality of life in patients affected by pelvis fractures is needed, at the light of these poor outcomes and taking into account the young average age in these patients.

We have hypothesized that a specific tactile and proprioceptive rehabilitation may reduce pain and sensory dysfunctions and we used a specific tool to perform perceptive rehabilitation called SUPER (SUrface for PErceptive Rehabilitation) [6].

This approach consists in providing somatosensory stimuli from back area in conjunction with specific perceptive exercises. Recently this rehabilitative technique has been showed to be effective in reducing pain [6] and to improve postural stability [7] in chronic and non specific low back pain.

Consequently, we have tested a specific ad hoc protocol of rehabilitation with perceptive surfaces in patients with chronic back pain due to pelvic fractures in polytrauma.

MATERIAL AND METHODS

Two patients with pelvis fracture due to trauma were involved in the study. The diagnosis of back pain due to pelvis fracture was made following this criteria: back

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pain at enrollment with a perceived pain score at VAS> 4; absence of a history of back pain before the fracture of the pelvis. The study was approved by a local ethical committee. All participants signed the informed consent. Patients were assessed before T0 and after Tend treatment, at the 12 and 24 weeks follow up T12 fup and T24fup respectively.

Case 1

Male patient of 42 years old, with a diagnosis of "polytrauma" with left acetabular fracture, diastasis of the symphysis pubis of 6 cm (“C” type of Tile Classification) [8-10], lacerated liver, was admitted to hospital "Salus Infirmorum" of Rome, unit of neuromotor rehabilitation, for rehabilitation using Super. The patient underwent surgery to apply external fixators to stabilize the pelvis. After two weeks post surgery there was an infectious complication to a dangerous generalized septic state, with inevitable removal of the external fixators. Then it has been proposed a non-intensive outpatient rehabilitative intervention with Super three weekly sessions of 45-60 minutes later for six months. The goals of rehabilitation treatment were: the control of back pain and pelvic pain, to facilitate the realignment of the symphysis pubis diastasis, to re-educate the biomechanical lumbar pelvic rhythm. The patient has had a ban to ambulate for the first three months of the trauma. Subsequently, specific exercises for the recovery of gait had been entered, with gradual weaning from aids (walker, crutches). A clinical diary was used to record the use of painkillers during treatment. During the first month, the patient has reduced the use of analgesics to 50% compared to T0, 10% at Tend. A T6fup the patient resorted to the use of analgesics only occasionally as needed.

The results showed a complete recovery of ambulation aids T24 f-up without a reduction in the lumbar-pelvic pain, and an improvement of disability due to trauma (see Table **1**).

Case 2

A young woman of 28 years old with a diagnosis of "polytrauma" reported multiple fractures to the left elbow, compound fracture of pelvis (“A” type of Tile Classification) [8-10] and finally the left extreme peripheral clavicle fractures and X and XI compound fracture of the left coast. She was admitted to "Salus Infirmorum" hospital of Rome, unit of neuromotor rehabilitation, for outpatient rehabilitation using Super, two months after trauma. Rehabilitation treatment had a duration of two months, three times a week for 45-60 minutes per session. The goals of rehabilitation treatment were: the control of back pain and pelvic pain, to facilitate the realignment of the trunk midline, to re-educate the biomechanical lumbar pelvic rhythm. At the initial assessment (T0) the patient still had problems during walking because pelvic pain. The patient had, in addition, back pain during respiration with significant postural asymmetry of the column for the pain. The rehabilitation using Super achieved the complete symmetry of the entire back with the disappearance of the sternal protrusion and the absence of pains of the column at T12fup and T24fup (see Table **1**). After two weeks of treatment with Super, the patient no longer used analgesics drugs.

The Visual Analogue Scale (VAS)

VAS is the most widely used, sensitive and reproducible instrument for the measurement of pain intensity where patients were asked to rate their pain during each assessment. It was used the classic version of the VAS that was administrated as a 10 cm horizontal line, with the end left labelled as “no pain” and the right end labelled as “the worst pain possible” [11].

Waddell Disability Index (WDI)

WDI is a simple nine-item scale to assess “basic physical activities of daily living commonly restricted by

Table 1: Results of the Two Case Reports

	Case 1			Case 2		
	VAS	WDI	ODI	VAS	WDI	ODI
T0	10	9	100	6	5	60
Tend	6	8	80	1	1	10
T12fup	2	4	50	0	0	10
T24fup	0	2	20	1	0	10

VAS, Visual Analogue Scale; WDI, Waddel Disability Index; ODI, Oswestry Disability Index; T0, before treatment; Tend, after treatment, T12 fup, 12 weeks follow up; T24fup, 24 weeks follow-up.

low-back pain". This is an unidimensional scale, easy to use in a few minutes, with dichotomous response choice. The questions are referenced, not to particular time period, but since the onset of the LBP. The maximum score is 9 points: a score > 5 indicates significant disability [12]. The easy-to-use of the WDI makes this scale particularly appealing as a potential measure of function in clinical practice.

The Oswestry Disability Index (ODI)

ODI is the most common measure for the assessement of the outcome of LBP. This scale evaluates the degree of functional impairments in activities of daily life caused by pain. It consists of 10 sections including pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex, social life and travelling. Each section includes six sentences relating to different levels of limitation in the same activity (0= no limitation; 5= maximal limitation). The score is interpreted as a percentage of patients-perceived disability [13].

Intervention

Surface for perceptive rehabilitation was developed as a new therapeutic system based on the interaction between patient's body surface and a perceivable supporting surface (Figures **1** and **2**) [6]. This support is a structure made of small latex cones, varying in measures (height: 3-7 cm; basis diameter: 2-4 cm, see Figure **2**) and elasticity. More then 100 cones are applied with their inferior bases on a rigid wood surface through stretch strips. Patient was asked to lay up supine on the surface formed by the smoothed apex of these cones. The reaction forces to the patient's weight generated by cones stimulated her/his cutaneous receptors inducing tactile and proprioceptive and pressure information to peripheral and central nervous system. The latex material was quite deformable. Different cones were used with an elasticity (capacity to vary their volumes) of 20%, 40% and 60%.

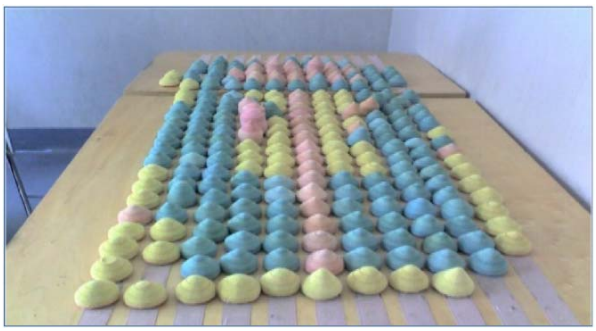

Figure 1: Surfaces for Perceptive Rehabilitation in a basic configuration.

Figure 2: Examples of the cones with different dimension that are used for perceptive rehabilitation.

During the first session of treatment, a standard distribution of the cones was used. In this configuration, an array of less deformable cones (i.e. poor elasticity) were used in correspondence of body midline (spinous processes), whereas more deformable cones were used for the other parts of the back. At the end of the session, physiotherapist investigated the interaction between back skin and surfaces relieving the hyperemic area in patient's back. During following sessions, cones with different elasticity were positioned by the therapist in order to improve the symmetry of the contact between surface and patient's back taking into account the hyperemia in the previous session.

Then, the patient performed a cognitive-perceptive rehabilitation, requiring attention and the capacity to discriminate tactile, proprioceptive, pressure and kinesthetic information, to interact actively with the contact surfaces. In a first phase of therapeutic session, the patient was asked to relax and to find the most comfortable position, breathing normally. Then, the patient performed active exercises consisting of tactile and proprioceptive tasks of increasing difficulty: to perceive the areas of support, to indicate the surface of the body in contact with a particular area, to describe and count the number of cones, to check the different distribution of load on the bed and try to correct it, to take attention to the posture. The patient was asked to evaluate how she/he perceives and feels: in particular, if load was uniformly and symmetry distributed in respect of trunk midline. Normally, sessions lasted around 45 minutes, and were carried out 3 times at week into around 1 month. In particular, the use of the specific device developed for this study can provide a strong tactile stimulation due to loads generated by the cones in reaction to the patient's weight. Furthermore, the patient was asked to perform some perceptive tasks related to her/his back midline perception and if she/he perceives a symmetric distribution of loads in respect of this line. For this reason, more rigid cones were located under back midline in order to increase

the pressure on the spinous processes and supraspinous ligament.

DISCUSSION

In this study we have tested the feasibility and the efficacy for the first time of the perceptive rehabilitative approach on two patients with back pain due to pelvis fracture.

Two patients were treated with SUPER showing a reduction of the back pain and an increased of the patients' function. Commonly, patients with pelvic fracture reported a significantly increase of pain and function reduction after injury [9,10].

The pain relief was major finding and is in accordance of previous study on perceptive surfaces in chronic low back pain [6]. This finding is important because patients with chronic pain due to pelvis fracture have poor beneficial from rehabilitation.

Our results support the hypothesis that tactile and proprioceptive rehabilitation stimuli might enhance sensory-motor control, also in patients affected by the sequela of pelvis fracture. These results are in accordance with previous studies on Perceptive Surfaces and chronic non –specific low back pain [6] and with the recent recommendations of Moseley and colleagues [14].

Proprioceptive and somatosensory stimuli play a fundamental role in the representation of body postures. In pain conditions, the real time body schema is altered [15]. According to these findings, a perceptive rehabilitation based on training with specific surfaces might allow a sensory-motor reconditioning and thus a posture improvement [7] A more specific technique focus on trunk, trunk midline perception and body schema rehabilitation may help to improve pain conditions and functional outcomes. This is due thanks to paraspinal muscle spindles that play a fundamental role in position sense and a mechanical stimulation of this muscle can improve proprioception and enhance local muscle control [16]. Furthermore an fMRI study has provided evidence about the importance of coetaneous regions adjacent to the trunk midline showing their bilateral representation in first somatic sensory cortex [17].

Our exercise protocol stress the idea based on the body midline realignment with gravitational axis by mean a perceptive and tactile task (recognition of the different cones). The reeducation of the somatosensory perception might be helpful in reducing pain and consequently trunk and back function in patient with chronic back pain. This is supported by a recent study that as shown the evidence of the somatosensory abnormalities for painful and innocuous stimuli at the back in chronic back pain patients. In this article authors show in add that the painful alteration might occur at a site distinct from the region of pain [18]. This scenario might explain positive results for our two cases in which a chronic pain primarily localized on the pelvis might lead to a chronically back pain condition sustained by somatosensory misperception.

In conclusion, our results suggest that perceptive surfaces for tactile and proprioceptive stimuli can be a promising approach for pain relief at short and long-term in LBP due to pelvis fracture. At the same time, it has to be highlighted as more data and controlled trials are needed to test this hypothesis.

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