

Efficacy of a specific rehabilitation protocol in postural control of a young woman with multiple fragility vertebral fractures: a case report

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Summary

The fragility vertebral fractures have a considerable impact on an individual's health-related quality of life due to pain, limitations in activity, social participation, altered mood and balance impairment. Physiotherapy interventions may have an important role in improving quality of life, balance and reducing the fracture risk in people with osteoporotic vertebral fractures.

In literature there are only a few studies that examine exercise interventions in osteoporotic populations with vertebral fracture and few studies that examine the effects on balance with instrumental measurements.

In this paper we present a case of a woman with fragility vertebral fractures and a related balance impairment and the effects of a specific rehabilitation program using both clinical evaluations that instrumental measurements.

KEY WORDS: rehabilitation; vertebral fracture; postural control; osteoporosis.

Introduction

The fragility vertebral fractures are a significant public health problem (1). In fact they can have a considerable impact on an individual's health-related quality of life due to pain, limitations in activity, social participation and altered mood (2). Vertebral fractures are related to increased thoracic kyphosis and loss of lumbar lordosis that are linked to increased spinal loading and back extensor muscles weakness. This can lead to an increased risk of further fracture (3). The balance disturbance with subsequent increased risk of falls is another relevant problem linked with vertebral fractures, even if the

underlying mechanisms remain unclear.

Physiotherapy interventions may have an important role in improving life quality, balancing and reducing the fracture risk in people with osteoporotic vertebral fractures.

In the literature there are only a few studies that examine exercise interventions in osteoporotic populations with vertebral fracture (4-6) and few studies that examine the effects on balance with instrumental measurements.

In this paper we present the effect of a specific rehabilitation program in a woman with fragility vertebral fractures presented to the multidisciplinary surgery for "diagnosis, therapy, rehabilitation of patients with vertebral fragility fracture" of Pisa, using clinical evaluation and instrumental measurements.

Case report

A 60-year-old woman with secondary osteoporosis presented two vertebral fractures (L1 and L4) after a fall. She was subjected to vertebroplasty on L1-L2-L3-L4. She has come to our attention to the multidisciplinary outpatient clinic for "diagnosis, therapy, rehabilitation of patients with vertebral fragility fracture" of Pisa University Hospital after 7 months from vertebroplasty. She still presented pain in particular in lumbar and sacral spine.

She was affected by rheumatoid arthritis and she was in therapy with corticosteroids. She has a positive family history for osteoporosis (mother with femoral fracture). Nothing else of relevance in history.

She was in therapy with methylprednisolone, methotrexate, alendronate, cholecalciferol, calcium carbonate.

At physical examination she showed pain on spinous processes L1 and L2. She has a limited spinal flexion, only slight limitation on hip internal rotation and ankle flexion. She was investigated for all this parameters: number of fallings in the last year (1 falling), walking test in 20m (26,1 second), Barthel index (7) (score: 95), cumulative illness rating scale (CIRS) (8) (CIRS severity: 1,3; CIRS comorbidities:1), geriatric depression scale short version (GDS) (9) (score: 11), VAS scale (neck score 4, dorsal score 0, lumbar score 8).

The health outcome is measured with the EuroQoL-5D (Eq-5D) (10). She indicated some problems for all dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression and she indicated a Global health of 40.

Height and weight was measured for calculation of Body Mass Index (BMI) that was 26,9. About the sagittal alignment, the occipital to wall distance was 5 cm. The scapular plane was 2 cm anterior than gluteal plane. The distance of apex of cervical lordosis from a virtual vertical plumb line was 9 cm, of lumbar lordosis 2 cm. In frontal plane the patient had asymmetry of the shoulder than the pelvis. The patient had a scar among breasts.

For the instrumental evaluation of the balance, static stabilometry was used, which evaluates the postural balance through the quantification of the postural sway in the

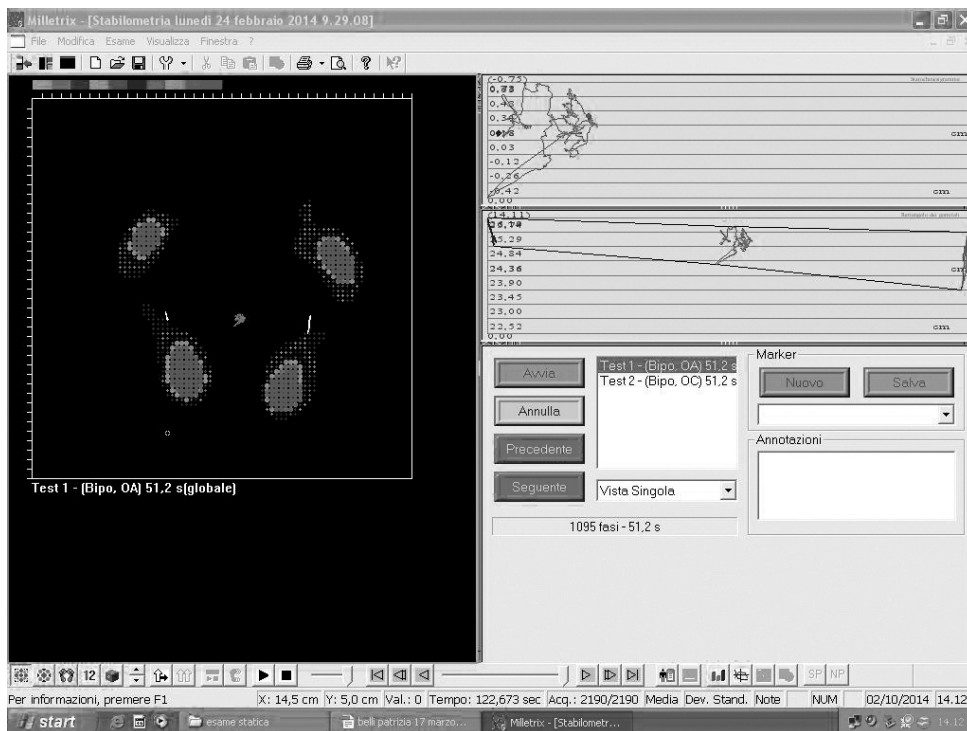


Figure 1 - COP's displacement.

orthostatic position on a force platform. The variables for analysis of the stabilometric test were: displacement and speed of displacement in the medial-lateral (ML) and anterior-posterior (AP) axes from the center of pressure (COP). During the test, the patient adopted the orthostatic posture standing on two feet, barefoot and with the ankles together, forming, between them, an angle of 30°, in line with the markings made on the surface of the force platform, and remained in that position for 52s with the eyes open. In addition to this, the patient was requested to keep her eyes fixed on a point established 2.5m from the center of the force platform at the height of her face, such that the patient should keep her head erect. Figure 1 shows the COP's displacement.

According to Italian law, ethical approval for this study was not required because it involved only routine clinical follow-up and instrumental examination. Written informed consent was obtained from patient. With this consent the patient authorizes the collection and publication of clinical data about her case for scientific and educational purposes even outside the institution.

Treatment

Tapentadol 50 mg and paracetamol 1 g was prescribed for pain. The patient was confirmed treatment with alendronate, cholecalciferol and calcium carbonate to decreased risk of new fractures that is present also in patients treated with percutaneous vertebroplasty (11).

The patient started a specific rehabilitation program for fragility vertebral fractures (10 daily sessions, each of 40 minutes). The protocol was composed of supine exercises with legs in unloading above the cube, exercises in sitting position and exercises in standing against the wall. The exercise concentrated on the back extensor and posterior trunk postural muscles in order to promote a neutral spinal posture. All exercises were of low intensity in order to minimize compression loads though

already-weakened vertebrae. In each position were performed proprioceptive exercises of trunk and pelvis.

Table 1 shows the results about clinical parameters before (T0) and after (T1) the rehabilitation program.

Table 1 - Results of clinical parameters at T0 and T1.

Clinical parameters	T0	T1
VAS scale neck	4	2
VAS scale dorsal	0	0
VAS scale lumbar	8	3
Heigh (cm)	162	163
Occipital to wall distance (cm)	5	5
Apex of cervical lordosis distance (cm)	9	9
Scapular plane distance (cm)	2	1
Lumbar lordosis distance (cm)	2	3
Gluteal plan distance (cm)	0	0
Walking test in 20m (sec)	26,1	23,8

About the health outcome the patient has a significant improvement in all dimensions of Eq-5D (T0: 0,19; T1: 0,53) and also in the Global health (T0: 40; T1: 80).

After treatment the patient had performed a new stabilometric test. The postural balance was improved after the protocol. The ellipse surface was 22,59 mm² after treatment (T1) instead of 63,81 mm² at T0. The COP resultant displacement (total path) was improved by 135,1 mm (T0) to 126,8 mm(T1); the

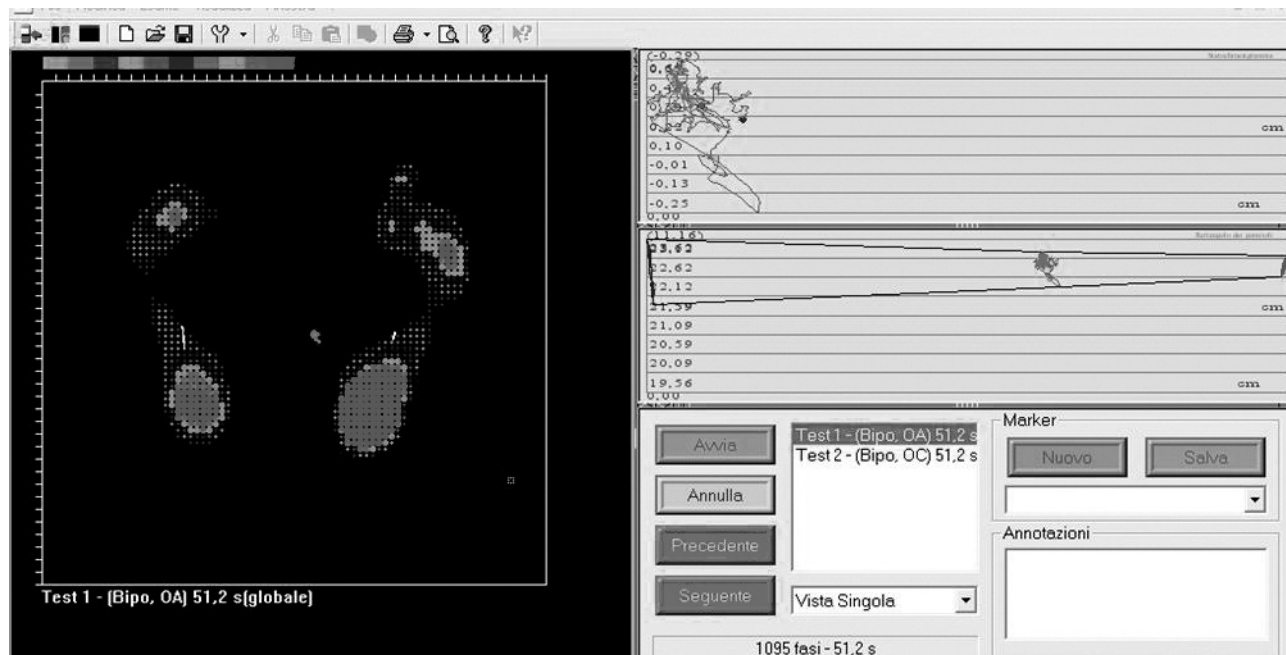


Figure 2 - COP's displacement after treatment.

COP resultant velocity was improved by 2,63 mm/sec (T0) to 2,47 mm/sec (T1). The COP's anterior-posterior velocity was improved by 1,52 mm/sec (T0) to 1,42 mm/sec (T1).

Figure 2 shows the COP's displacement after the treatment.

Discussion

This paper presents the case of a woman with fragility vertebral fractures (L1,L4) treated with vertebroplasty (L1,L2, L3,L4), subjected to a specific rehabilitation program. Based on the concept that back extensors weakness is associated with vertebral fractures and can be a key element in the pathophysiology of flexed posture, exercises for strengthening of back extensor muscles were included in our protocol.

The exercises proposed were well tolerated and there weren't no adverse effects. Good results have been achieved with the specific rehabilitation program. The lumbar VAS score is changed from 8 (T0) to 3 (T1), the walking test is changed from 26,1 sec (T0) to 23,8 sec (T1). The health outcome is improved in all dimensions of Eq-5d (T0:0,19; T1:0,53) and also in the Global health (T0: 40;T1: 80).

Good results have been achieved also in sagittal alignment. Scapular plan distance is changed from 2 cm (T0) to 1 cm (T1), the lumbar lordosis distance from 2 cm (T0) to 3 cm (T1). The height is changed from 162 cm to 163 cm.

The fact that rises interest in this case is the stabilometric evaluation. In fact even though she doesn't have significant posture disorders, the COP' displacement shows an impaired postural control. The mechanisms underlying postural control are not clear yet. Flexed posture and the degree of kiphosis can influence the postural balance. Our patient didn't have significant posture disorder, she was relative young (60 years old), she had a comorbidity CIRS score of 1 and a Barthel score of 95. Despite this the COP's displacement shows an impaired postural control. There is evidence that patients with chronic low back pain have poorer postural control (12). The patient in fact has a VAS score of 8. The postural control is also in-

fluenced by reduced mobility (13) and the fear of falling (14), in fact the patient has a reduced mobility of the spine and a GDS score of 11. After the rehabilitation program the COP's displacement is improved with a reduction in COP' mean velocity and in COP's anterior-posterior velocity.

In conclusion the specific rehabilitation program proposed to this patient has showed good results about pain, health outcome, postural alignment and postural balance. In the literature there are no standardized protocols for the treatment of patients with fragility vertebral fractures. This is only a single case but of a standardized protocol currently applied to all patients who belong to the multidisciplinary outpatient for "diagnosis, therapy, rehabilitation of patients with vertebral fragility fracture" of Pisa University Hospital. The mechanism underlying postural control are not clear yet. The instrumental evaluation of postural balance is important for an early and clear diagnosis of postural imbalance and to identify with more accuracy the patients that need rehabilitation.

Disclosure

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References

1. Piscitelli P, Tarantino U, Chitano G, Argentiero A, Neglia C, Agnello N, Saturnino L, Feola M, Celi M, Raho C, Distanto A, Brandi ML. Updated incidence rates of fragility fractures in Italy: extension study 2002-2008. *Clin Cases Miner Bone Metab*. 2011 Sep;8(3):54-61.
2. Karen L Barker, Muhammad K Javaid, Meredith Newman, Catherine Minns Lowe, Nigel Stallard, Helen Campbell, Varsha Gandhi, Sallie Lamb. Physiotherapy Rehabilitation for Osteoporotic Vertebral Fracture (PROVE): study protocol for a randomised controlled trial. *Trials*. 2014 Jan 14;15:22. doi: 10.1186/1745-6215-15-22.
3. Huang M-H, Barrett-Connor E, Greendale GA, Kado DM. Hyperkyphotic posture and risk of future osteoporotic fractures: The Rancho Bernardo Study. *J Bone Miner Res*. 2006;21:419-423.

4. Bergland A, Thoresen H, Karesen R. Effect of exercise on mobility, balance, and health-related quality of life in osteoporotic women with a history of vertebral fracture: a randomised controlled trial. *Osteoporos Int.* 2010;22:1863-1871.
5. Gold DT, Shipp KM, Pieper CF, Duncan PW, Martinez S, Lyles KW. Group treatment improves trunk strength and psychological status in older women with vertebral fractures: results of a randomized clinical trial. *J Am Geriatr Soc.* 2004;52:1471-1478.
6. Papaioannou A, Adachi JD, Winegard K, Ferko N, Parkinson W, Cook RJ, Webber C, McCartney N. Efficacy of home-based exercise for improving quality of life among elderly women with symptomatic osteoporosis-related vertebral fractures. *Osteoporos Int.* 2003;14:677-682.
7. Mahoney FI, Barthel DW. Scala di valutazione delle attività della vita quotidiana (Barthel Index) *Mar St Med J.* 1965;14:61-65.
8. Parmalee PA, Thuras PD, Katz IR, Lawton MP. INDICE DI COMORBIDITÀ (CIRS) Validation of the Cumulative Illness Rating Scale in a geriatric residential population. *J Am Geriatr Soc.* 1995;43:130-137.
9. Jerome A Yesavage. Geriatric Depression Scale. *Psychopharmacology Bulletin.* 1988;24:4:709-711.
10. Balestroni G, Bertolotti G. L'EuroQol-5D (EQ-5D): uno strumento per la misura della qualità della vita. *Monaldi Arch Chest Dis.* 2012;155-159.
11. Mazzantini M, Carpeggiani P, d'Ascanio A, Bombardieri S, Di Munno O. Long-term prospective study of osteoporotic patients treated with percutaneous vertebroplasty after fragility fractures. *Osteoporos Int.* 2011 May;22(5):1599-607.
12. Radebold A, Cholewicki J, Polzhofer GK, Green HS. Impaired postural control of the lumbar spine is associated with delayed muscle response times in patients with chronic idiopathic low back pain. *Spine (Phila Pa 1976).* 2001 Apr 1;26(7):724-30.
13. Briggs AM, Greig AM, Bennell KL, Hodges PW. Paraspinal muscle control in people with osteoporotic vertebral fracture. *Eur Spine J.* 2007;1137-44.
14. Carpenter MG, Frank JS, Silcher CP, Peysar GW. The influence of postural threat on the control of upright stance. *Exp Brain Res.* 2001 May;138(2):210-8.