SPINE Volume 32, Number 19, pp 2099–2102

Hip-Spine Syndrome

The Effect of Total Hip Replacement Surgery on Low Back Pain in Severe Osteoarthritis of the Hip

Peleg Ben-Galim, MD,* Tal Ben-Galim, MD,† Nahshon Rand, MD,‡ Amir Haim, MD,* John Hipp, PhD,§ Shmuel Dekel, MD, PhD,* and Yizhar Floman, MD‡

Study Design. Prospective clinical study on the effect of total hip replacement surgery (THR) on low back pain (LBP) in patients with severe hip osteoarthritis.

Objective. To assess the affect of THR on LBP.

Summary of Background Data. Hip osteoarthritis causes abnormal gait and spinal sagittal alignment and is associated with LBP.

Methods. All consecutive adults scheduled for THR in our department due to severe hip osteoarthritis were assessed by an independent investigator before surgery and 3 months and 2 years post-THR. The Harris Hip Score and the Oswestry scores were used to evaluate hip- and spine-related symptoms, respectively, as were visual analogue scales (VAS) and sagittal spinal radiographs.

Results. Twenty-five patients (10 males; age range, 32–84 years) were evaluated. Both spinal and hip pain and function were significantly better following THR. The mean preoperative LBP VAS score of 5.04 was 3.68 after THR ($P = 0.006$). The mean preoperative Oswestry score of 36.72 was 24.08 after THR ($P = 0.0011$). Clinical improvement was maintained and enhanced at the 2-year follow-up. The mean hip pain VAS score was 7.08 before THR and 2.52 after THR ($P < 0.01$). The mean Harris Hip Score was 45.74 before and 81.8 after surgery ($P < 0.01$). There were no changes in the radiographic measurements.

Conclusion. Both LBP and spinal function were improved following THR. This study demonstrates the clinical benefits of THR on back pain and is the first to clinically validate hip-spine syndrome as hypothesized by Offierski and MacNab in 1983.

Key words: hip-spine syndrome, low back pain, hip pain, hip osteoarthritis. **Spine 2007;32:2099–2102**

Severe osteoarthritis of the hip joint may cause abnormal spinal sagittal alignment and difficulty in maintaining proper balance as well as a wobbling gait. It can also be associated with low back pain (LBP). This syndrome ("hip-spine") was originally described by Offierski and MacNab over 3 decades ago[1]; and although it is frequently cited, there have been no prospective clinical reports on the influence of total hip replacement (THR) surgery on LBP, spinal function, and symptomatology. Offierski and MacNab had described a case of a 72-year-old female patient who had what they called "secondary" hip-spine syndrome. She had low back and anterior thigh pain, degenerative changes in the lumbar spine, and osteoarthritis of both hips. Her back pain disappeared after she underwent bilateral THR.

THR is effective in alleviating hip pain and improves hip function and gait.[2,7] The purpose of the current study is to test MacNab's hip-spine syndrome in a clinical setting by assessing whether relief of hip symptoms can also relieve back pain. We hypothesized that improvement in hip function and reduction of hip pain following THR would also have a positive effect on spinal posture and symptoms.

Methods

Setting and Participants

This study was conducted between 2003 and 2006 and approved by the Tel-Aviv Sourasky Medical Center institutional review board. All suitable patients were familiarized with the nature of this investigation and signed an informed consent form. The study cohort consisted of patients who had been referred for elective orthopedic consultation to the Tel-Aviv Sourasky Medical Center Department of Orthopedic Surgery "B" because of severe hip pain, difficulty in walking, and a limping gait. Twenty-five consecutive adults who were scheduled for THR surgery due to documented severe hip joint osteoarthritis were recruited and prospectively followed. Inclusion criteria were clinical evidence of debilitating hip pain with limited range of motion and radiographic signs of severe osteoarthritic hip joint changes. Exclusion criteria were previous lumbar spinal fusion or instrumentation surgery, spondylolisthesis, symptomatic spinal stenosis, current medical treatment for LBP, radicular leg pain, any condition confounding evaluation of treatment outcomes (*e.g.*, vascular claudication, previous major trauma, diabetic polyneuropathy), any contraindication to conservative spinal treatment (*e.g.*, cauda equina syndrome, progressive neurologic deficit, or intolerable pain), spinal deformity or any inflammatory, infectious, or neoplastic disease of the spine, pelvis, or hip, severe degenerative changes in the lumbar spine, inability to understand or complete the functional outcome questions, or unwillingness to participate in this study.

From the *Department of Orthopedic Surgery "B," Tel-Aviv Sourasky Medical Center, Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, Israel; †Hadassah Medical School, Kiryat Hadassah, Jerusalem, Israel; ‡Israel Spine Center, Assuta Hospital, Tel-Aviv, Israel; and §Department of Orthopedic Surgery, Baylor College of Medicine, Houston, TX.

Acknowledgment date: February 5, 2007. First revision date: March 11, 2007. Acceptance date: March 13, 2007.

Supported by the Department of Orthopedic Surgery "B," Tel-Aviv Sourasky Medical Center, Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, Israel, and Israel Spine Center, Assuta Hospital, Tel-Aviv, Israel.

The manuscript submitted does not contain information about medical device(s)/drug(s).

No funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Address correspondence and reprint requests to Peleg Ben-Galim, MD, Department of Orthopedic Surgery, Baylor College of Medicine, 1709 Dryden St., 12th floor, Houston, TX 77030; E-mail: pelegbg@gmail.com

Table 1. Median Preoperative and Postoperative Back and Hip Pain Scores

	Preoperative Baseline	First Follow-up Post-Hip Arthroplasty (25 Patients)	Second Follow-up Post-Hip Arthroplasty (17 Patients)
Back VAS	5.04	3.68 ($P = 0.006$)	3.64 ($P = 0.2$)
Oswestry	36.72	24.08 ($P = 0.0011$)	19.8 ($P = 0.25$)
Hip VAS	7.08	2.52 ($P < 0.0001$)	0.76 ($P = 0.0002$)
HHS	45.74	81.8 ($P < 0.0001$)	86 ($P = 0.027$)

VAS indicates visual analog scale; HHS, Haris Hip Scores.

Study Design

Protocol. Patients completed a baseline questionnaire on demographic characteristics, potential confounders, and factors related to hip and spine symptoms. They gave a detailed medical history and underwent a thorough physical examination of the hip and spine. All patients were assessed before surgery by an independent investigator (T.B.-G., medicine intern) and again when they achieved independent ambulation following standard unilateral THR surgery (no earlier than 3 months post-THR). Reassessment was performed 2 years after surgery.

Postoperative treatment included physical therapy with ambulation accessories (walker, cane, *etc.*) initially in the ward and on a home-based protocol thereafter. The patients in this study were not given any additional or specific therapy for their back pain in addition to our departments' routine THA protocol.

Clinical Outcome Measures. Hip and LBP intensities were independently evaluated as the primary outcome measures using visual analogue scales (VAS) specific to the hip and spine. Hip and spine functions were measured using validated instruments at every follow-up. The Harris Hip Score[8] was used to evaluate hip-related symptoms, and the Oswestry disability index[9] was used to evaluate spine-related symptoms.

Radiographic Outcome Measures. All patients had standing lateral radiographs of the entire spine on 36-inch-long cassettes (scoliosis films) as described by Jackson and McManus[10] before and at 3 months following THR surgery. The sacral inclination angle and the lumbar total lordosis angle were measured at 3 months following THR, and the obtained values were compared with those of the preoperative baseline.

Statistical Analysis

Paired *t* tests and Wilcoxon tests were used to identify changes in pain and function and in radiographic findings before and after THR.

■ Results

Patients

The final study population consisted of 25 consecutive patients scheduled for THR. There were 15 females and 10 males with a mean age of 67.4 years (range, 32–84 years).

Follow-up

Information was obtained for all 25 initial patients (100%) when they achieved independent ambulation 3 to 5 months following THR surgery. Data were available at the 2-year follow-up for 17 (74%) patients: 2 were known to have died and 6 were lost to final follow-up.

Clinical Outcomes

All patients in the study group had hip osteoarthritis and were found to have at least moderate LBP and spinal disability before hip surgery. Following hip arthroplasty, their LBP VAS and Oswestry disability index significantly improved. The mean LBP VAS score dropped from 5.04 to 3.68 ($P = 0.006$). The mean baseline Oswestry spinal index of 36.72 dropped to 24.08 at first postoperative follow-up ($P = 0.0011$). Hip pain VAS scores and Harris Hip Scores were significantly improved following THR. The mean hip pain VAS scores were 7.08 before and 2.52 after THR surgery ($P < 0.01$). The preoperative Harris Hip Score of 45.74 was 81.8 after the surgery ($P < 0.01$).

At the 2-year follow-up, the hip pain VAS and Harris Hip Scores continued to improve significantly. Likewise, there was an improvement in the Oswestry Disability Index. The post-THR surgery improvement in LBP VAS score was maintained at the 2-year follow-up, although this did not change significantly from the findings at the 3-month examination.

All the data for VAS, Harris, and Oswestry Disability Index at baseline and at first and second post-THR follow-up are shown in Table 1 and Figures 1 and 2.

Radiographic Outcomes

Spinal radiographic measurements did not differ before and after hip surgery. The mean sacral inclination angles were 39° before and 38° after THR. The mean total lumbar lordosis angles were 50.36° before and 50.32° after THR.

■ Discussion

The results of this study are the first to clinically validate the hypothesis underlying MacNab's hip-spine syndrome by documenting the improvement in LBP and function subsequent to total hip arthroplasty. All the patients were diagnosed as having hip joint osteoarthritis and had at least a moderate degree of LBP and disability before undergoing surgery. Although these patients were not seeking medical treatment for LBP and did not have severe degenerative lumbar changes on radiographs (as this was an exclusion criteria), they all had back pain. Interestingly, these patients' perception of LBP averaged 5.04/10, a value not much lower than the disabling, severe hip pain (7.08/10) for which they sought surgical treatment.

As expected, THR surgery significantly improved hip functional scores and symptoms and, as hypothesized,

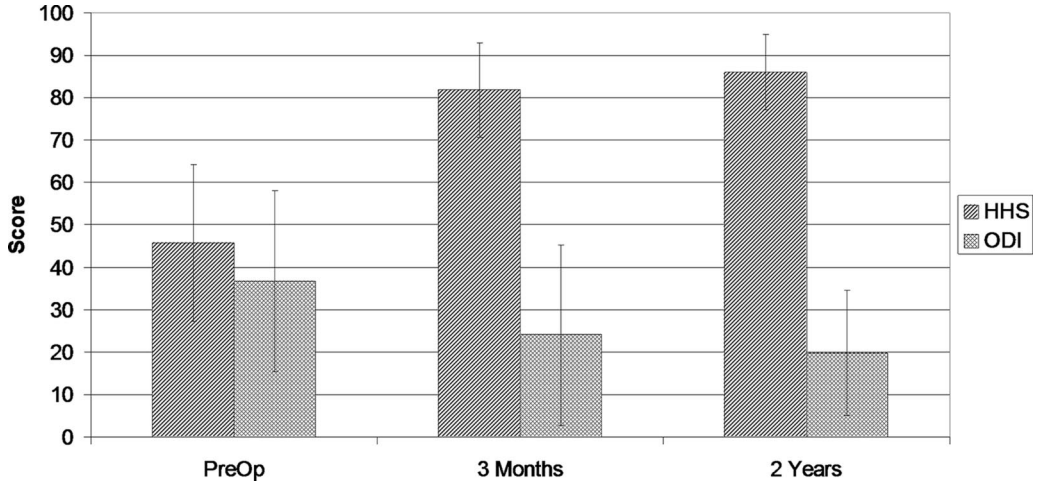

Figure 1. Low back and hip function before and following hip arthroplasty. Based on paired *t* tests, there was a significant ($P < 0.0001$) increase in the Harris Hip Scores (HHS) and a significant ($P = 0.0011$) decrease in the Oswestry Disability Index (ODI) scores between the preoperative (PreOp) and 3-month postoperative scores. There was a modest but significant ($P = 0.027$) additional improvement in the HHS at 3 months and at 2 years. The slight decrease between the ODI score at 3 months and at 2 years was not significant ($P = 0.25$).

the improvement in hip pain and function occurred simultaneously with a modest clinical improvement in spinal pain and function. Moreover, the 24-month follow-up findings revealed that further improvement in hip function corresponded with continued improvement of spinal function and reduced LBP.

The association between sagittal balance and low back and hip symptoms has been reported by many authors who used a diversity of measurement angles and correlations.[10,18] These reports all document sagittal measures in different groups of patients but do not prospectively follow these measures as a function of time or treatment. To the best of our knowledge, our current paper demonstrates the first comparison of radiographic sagittal lumbar lordosis and sacral inclination before and after THR, using each patient as his/her own control. The lack of change in spinal sagittal radiographic angles was surprising, and we speculate that it may be related to the radiographic technique rather than to the true clinical posture or gait. A critical association between a patient's voluntary posture and sagittal alignment as seen on film was described by Harrison *et al*,[19] whereby anterior and posterior translations of the thoracic cage had a significant affect on the sagittal lumbar spine and pelvic tilt. Since our patients had been verbally instructed to stand upright with their hands forward holding a bar positioned at the height of their head, the sagittal spinal radiographic appearance could be related to their choice of positioning and not to their true walking posture or gait pattern.

This prospective study used validated and reliable functional outcome scores, and each patient served as his/her own self control. One limitation is the small number of patients in the study group, although the association between treatment of hip osteoarthritis and spinal symptoms did reach a level of significance. Larger studies would enable the drawing of firm conclusions about hip-spine syn-

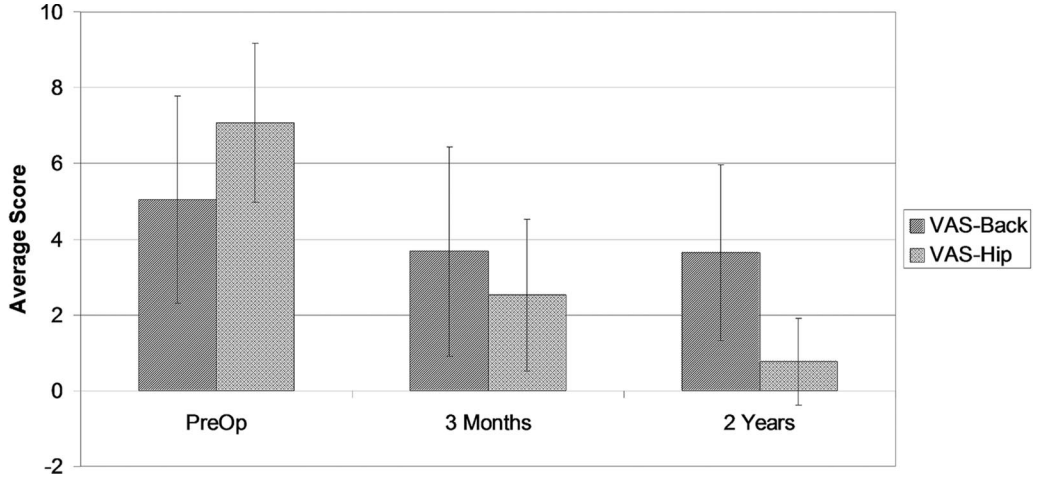

Figure 2. Low back and hip pain before and following hip arthroplasty. Based on paired *t* tests, there was a significant decrease in the visual analog scale (VAS) for low back pain ($P = 0.006$) and in the VAS for hip pain ($P < 0.0001$) between the preoperative (PreOp) and the 3-month postoperative follow-up values. The VAS for low back pain at the 3-month and 2-year follow-up visits was not significantly different ($P = 0.20$), but the VAS for hip pain was significantly lower at 2 years ($P = 0.0002$).

drome and its relation to specific subgroups of patients with hip osteoarthritis. Also, since patients included in this study did not have primary back pain as an initial complaint and were not associated with spinal deformity or neurologic deficit, no conclusion can be drawn regarding patients with hip osteoarthritis as well as these conditions.

The results of this study emphasize the need to treat hip osteoarthritis primarily. Reassessment of back pain following hip arthroplasty may show diminished symptoms and obviate the need for spinal treatment.

■ Key Points

- The hip-spine syndrome is a valid clinical entity.
- All our patients with severe hip osteoarthritis had at least a moderate degree of LBP.
- LBP and diminished spinal functional scores (Oswestry) were associated with severe osteoarthritis of the hip.
- Significant clinical improvement in LBP and spinal functional scores (Oswestry) may be expected following treatment of hip osteoarthritis (total hip replacement surgery).
- In patients with both hip osteoarthritis and LBP, the hip osteoarthritis should be treated first.

Acknowledgments

The authors thank Esther Eshkol for editorial assistance and Ilana Almagor and the orthopedic clinic secretaries, Michal, Ahuva, and Rivkah for their assistance.

References

1. Offierski CM, MacNab I. Hip-spine syndrome. *Spine* 1983;8:316–21.
2. Buckwalter JA, Saltzman C, Brown T. The impact of osteoarthritis: implications for research. *Clin Orthop* 2004;427(suppl):6–15.
3. Malchau H, Herberts P, Eisler T, et al. The Swedish Total Hip Replacement Register. *J Bone Joint Surg Am* 2002;84(suppl 2):2–20.
4. Lucht U. The Danish Hip Arthroplasty Register. *Acta Orthop Scand* 2000; 71:433–9.
5. D'Ambrosia RD. Epidemiology of osteoarthritis. *Orthopedics* 2005; 28(suppl 2):201–5.
6. Hunter DJ, Felson DT. Clinical review: osteoarthritis. *BMJ* 2006;332: 639–42.
7. Morrey BF, Adams RA, Kessler M. A conservative femoral replacement for total hip arthroplasty: a prospective study. *J Bone Joint Surg Br* 2000;82: 952–8.
8. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. *J Bone Joint Surg Am* 1969;51: 737–47.
9. Fairbank JC, Couper J, Davies JB, et al. The Oswestry low back pain disability questionnaire. *Physiotherapy* 1980;66:271–3.
10. Jackson RP, McManus AC. Radiographic analysis of sagittal plane alignment and balance in standing volunteers and patients with low back pain matched for age, sex, and size: a prospective controlled clinical study. *Spine* 1994;19:1611–8.
11. Itoli E. Roentgenographic analysis of posture in spinal osteoporotics. *Spine* 1991;16:750–6.
12. Williams MM, Hawley JA, McKenzie RA, et al. A comparison of the effects of two sitting postures on back and referred pain. *Spine* 1991;16: 1185–91.
13. Norton BJ, Sahmann SA, Van Dillen FL. Differences in measurements of lumbar curvature related to gender and low back pain. *J Orthop Sports Phys Ther* 2004;34:524–34.
14. Evcik D, Yucel A. Lumbar lordosis in acute and chronic low back pain patients. *Rheumatol Int* 2003;23:163–5.
15. Rajnics P. The importance of spinopelvic parameters in patients with lumbar disc lesions. *Int Orthop* 2002;26:104–8.
16. Matsuyama Y, Hasegawa Y, Yoshihara H, et al. Hip-spine syndrome: total sagittal alignment of the spine and clinical symptoms in patients with bilateral congenital hip dislocation. *Spine* 2004;29:2432–7.
17. Yoshimoto H, Sato S, Masuda T, et al. Spinopelvic alignment in patients with osteoarthrosis of the hip: a radiographic comparison to patients with low back pain. *Spine* 2005;30:1650–7.
18. Rand D, Patlas M, Matan Y, et al. Sagittal alignment of the spine in patients with advanced osteoarthritis of the hips [Paper No. 64]. *23rd Annual Meeting of the International Society for the Study of the Lumbar Spine*. Burlington, VT, June 1996:25–9.
19. Harrison DE, Cailliet R, Harrison DD, et al. How do anterior/posterior translations of the thoracic cage affect the sagittal lumbar spine, pelvic tilt and thoracic kyphosis. *Eur Spine J* 2002;11:287–93.