Orthopaedics & Traumatology: Surgery & Research 102 (2016) 765–768

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Original article

Does the type of sagittal spinal shape influence the clinical results of lumbar disc arthroplasty?

F. Laouissat [a,*], C. Scemama [b], J. Delécrin [c]

[a] Hôpital privé de l'Est-Lyonnais, Chirurgie du rachis, Saint-Priest, France
[b] Hôpital Pitié-Salpêtrière, Paris, France
[c] Clinique chirurgicale de l'Hôtel-Dieu, CHU de Nantes, Nantes, France

ARTICLE INFO

Article history:
Received 31 January 2016
Accepted 25 May 2016

Keywords:
Lumbar total disc replacement
Clinical results
Sagittal spinal shape
Hyperlordosis
Roussouly classification

ABSTRACT

Introduction: It has been suggested that the indication for lumbar total disc replacement (LTDR) takes into account the local parameters, such as the type of disc disease demonstrated on MRI and the presence or absence of facet joint osteoarthritis. The type of preoperative sagittal curvature could also be taken into account. This study reports the clinical results of LTDRs depending on the type of sagittal spinal alignment.

Material and methods: Eighty patients were included in this prospective study, with a mean age of 41.7 years (range, 27–56 years). The clinical analysis took into account the lumbar VAS, the Oswestry Disability Index (ODI), and the preoperative frequency of painkiller use, at 1 year and at the last follow-up. The satisfaction index, return to work, and willingness to undergo the same treatment were also collected. The radiological study included the analysis of lumbar-pelvic parameters to distribute the patients according to the Roussouly classification.

Results: The mean follow-up was 59.1 months (range, 14–96 months). The type 1 group included four cases. Reduction of the VAS, the ODI score, and the frequency of painkiller use at the last follow-up were significant in type 2 and 3 patients, and non-significant for type 4. Eighty-five percent of type 2 patients and 87.5% of type 3 patients were satisfied or very satisfied with the surgery versus only 68% of the type 4 patients. In addition, 63% of the type 4 patients declared they would be willing to undergo the same treatment again versus 85% of the type 2 patients and 82.5% of the type 3 patients. It should also be noted that 67% of the patients in this series returned to work.

Discussion and conclusion: This study underscores the influence of the type of sagittal curvature on the clinical results of LTDR, with type 4 patients showing inferior clinical results because of a higher rate of residual lower back pain. The indication in LTDR should be reconsidered for discogenic lower back pain in type 4 patients.

1. Introduction

Lumbar disc arthroplasty seems to be an alternative to arthrodesis in the treatment of certain cases of discogenic low back pain. The main advantage of lumbar total disc replacement (LTDR) is to restore the range of motion of the operated intervertebral segment [1]. In contrast to lumbar arthrodesis, this principle of restoring range of motion stipulates functional restoration for LTDR, aiming to prevent degeneration of the adjacent segments.

In certain studies, the therapeutic success of LTDR has been conditioned by radiological parameters, such as the preoperative MRI aspect of the vertebral endplates [2], the presence or absence of facet joint osteoarthritis [3–5], or the postoperative positioning of the implant [6,7].

Similarly, it has been suggested that the results of LTDR depended on morphological parameters. The influence of the type of sagittal curvature (referring to the Roussouly classification [8,9]) has only been studied very recently. Dividing sagittal curvature into four types, the Roussouly classification describes the degenerative progression specific to each type of lumbar segment based on a biomechanical approach [10]. Type 1, a short lower lumbar hyperlordosis, caused by a small-radius inferior arch, concentrates the maximum stresses on the zygapophyseal facets of the two last mobile segments L4–L5 and L5–S1. Type 2, with flat lumbar

* Corresponding author. Hôpital privé de l'Est-Lyonnais, Spine surgery, 140, rue Andre-Lwoff, 69800 Saint-Priest, France. Tel.: +33 4 72 79 11 28.
E-mail addresses: flaouissat@gmail.com, legionela@hotmail.fr (F. Laouissat).

http://dx.doi.org/10.1016/j.otsr.2016.05.012
1877-0568/

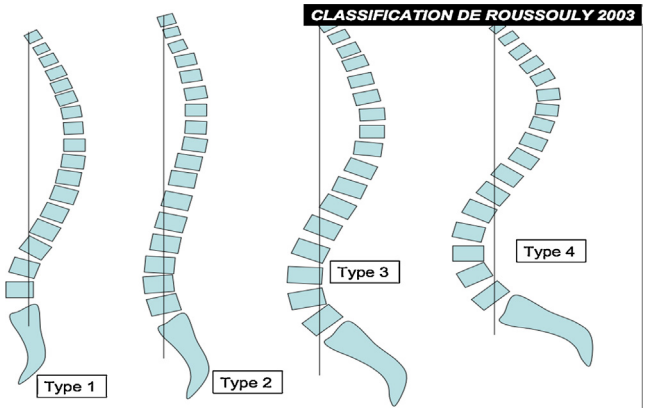

Fig. 1. Roussouly's four types of sagittal curvature.

lordosis, is predisposed to disc disease and herniated disc, notably in young subjects. Type 3, the most frequent, is balanced, and type 4 with substantial lumbar lordosis is subject to facet joint osteoarthritis, canal stenosis, and degenerative spondylolisthesis.

Two studies reported variable results according to the sagittal curvature. Based on a radiological study, Pellet et al. [11] reported that types 3 and 4 may obtain better restoration of the sagittal profile following an L5–-S1 arthrodesis compared to disc arthroplasty at the same level, but the clinical results were not compared. With a small number of cases, Strube et al. [12] suggested a possible contraindication to lumbar disc arthroplasty at L4–L5 and L5–S1 for types 1 and 4, based on inferior clinical results. In both studies, type 4 appears to be a sagittal profile correlated with inferior clinical or radiological results.

The present prospective study aimed to assess the clinical and functional results obtained over the medium term after LTDR in relation to the type of sagittal profile of the patients' lumbar segment, to select the sagittal spinal shape that may be determinant in the indication for TLDR.

2. Materials and methods

This was a prospective study on 80 patients who underwent TLDR between L2 and S1, recruited from January 2004 to January 2014. All patients presented a clinical history of low back pain resisting to a well-conducted conservative treatment for at least 6 months causing a measured functional handicap before being included in the study. They also presented radiological proof of disc degeneration (standard X-ray, CT, MRI, and/or discography).

The inclusion criteria were a non-operated degenerative disc disease (DDD) or a DDD with history of nucleotomy or discectomy. Patients were excluded if they presented non-discogenic low back pain, multiple disc degeneration, scoliosis or spondylolisthesis, advanced facet joint osteoarthritis, lumbar canal stenosis, a posterior postoperative defect (laminectomy or facetectomy resulting in loss of stabilizing components), a disc sequestrum with a hernia that could not be removed via an anterior approach, osteoporosis or metabolic bone disease.

Three generations of mobile-nucleus disc prosthesis were implanted via the left or right retroperitoneal approach by a senior operator following the same protocol [13].

Patient selection and preoperative assessment were conducted by the surgeon who placed the implants. Digital static profile X-rays of the entire spine, with visualization of the femoral heads, were taken preoperatively for the sagittal morphological study of spine curvature with reference to the Roussouly classification [8] (Fig. 1). The digital X-rays were analyzed using SpineViewR (Surgiview, Paris, France). All the patients signed an informed consent form

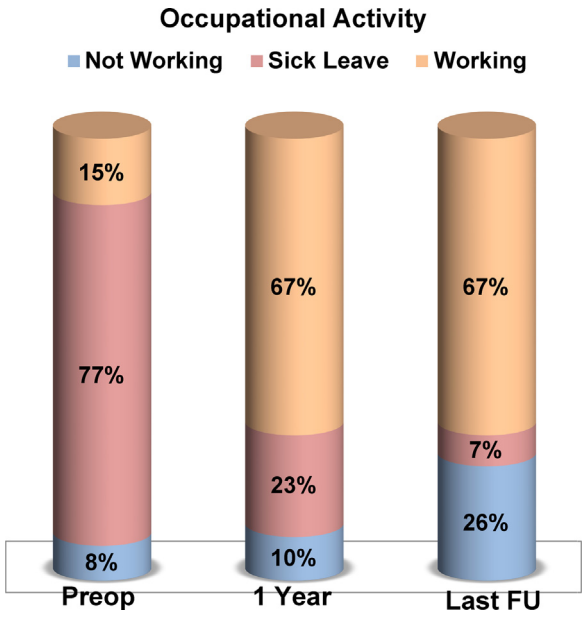

Fig. 2. Histogram illustrating distribution of the occupational activity level of the operated patients, preoperative and at different follow-up times.

for use of their clinical and radiological data for this observational study.

The main endpoint was functional symptoms, whose characteristics (lumbar visual analog scale [VAS] and the Oswestry Disability Index [ODI]) were collected from self-administered questionnaires completed before surgery, at 1 year postoperative, and at the last follow-up. The analogic pain scale or the lumbar VAS were scored from 0 to 10. The ODI questionnaire, expressed as percentages, was a functional score assessing functional incapacity comprising ten questions with six responses, each scored from 0 to 5 in increasing order for functional discomfort. Also, a satisfaction questionnaire (scored as very satisfied, satisfied, dissatisfied or very dissatisfied with the surgery) and a final satisfaction index questionnaire (the patients responded to the question "if the surgery had to be redone, would you do it?") were completed at the last follow-up. The secondary endpoints were postoperative complications, non-opïoid analgesic use quantified in terms of frequency (continuous, occasional, or none), return to work (working, on sick leave, or not working) at the last follow-up compared to the preoperative period (Fig. 2). The results were analyzed by an author who was not involved in patient selection, the surgery, or the postoperative care.

The qualitative variables were analyzed using the Fisher test. The Wilcoxon and *t*-test were used to analyze the means.

3. Results

Eighty-four patients were operated between L2 and S1, from January 2004 to January 2014. The mean age was 41.7 years (range, 27–56 years). There was a slight predominance of females with 46 females versus 34 males. The mean follow-up was 59.1 ± 24.7 months. None of the patients was lost to follow-up, one patient died, and one patient refused the clinical follow-up but continued to respond to the self-administered questionnaires.

The majority of the LTDRs were implanted at the L4–L5 and L5–S1 levels (41% and 57%, respectively). LDTR at the L2–L3 and L3–L4 levels was marginal, with one prosthesis for each level. The distribution of implantation levels is summarized in Table 1.