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Outcomes of autograft alone versus PEEK+ autograft interbody fusion in the treatment of adult lumbar isthmic spondylolisthesis

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ABSTRACT

Objectives: Bone resulting from a complete resection of the posterior arch can be cut into an autograft bone that contains the facet joint structure and morselised bone for interbody fusion. However, whether a strut autograft that contains this trimmed facet joint can produce the same clinical and radiographic outcomes as a cage for interbody fusion remains unclear. The aim of this study was to compare the outcomes of a local facet joint autograft alone to those of polyetheretherketone (PEEK) + autograft for posterior lumbar interbody fusion (PLIF) in the treatment of adult isthmic spondylolisthesis.
Patients and methods: A retrospective analysis was performed on 84 patients with single lumbar isthmic spondylolisthesis who were treated with a local facet joint autograft alone (group A; n = 44) or PEEK + autograft (group B; n = 40) in PLIF with a minimum follow-up period of 24 months. Pain and disability were assessed using the visual analogue scale, Oswestry disability index and Kirkaldy-Willis criteria. In the radiological evaluation, disc height, slippage reduction, and fusion status were examined. Postoperative complications were also monitored.
Results: At the last follow-up examination, 84.1% (37/44) of the patients in group A and 82.5% (33/40) of the patients in group B had a good outcome, and there were no significant differences between the two groups. Boh Methods led to significant improvements in disc height, and while PEEK + autograft produced a smaller loss in disc height, the difference was insignificant. The improvements in slippage and the fusion and complication rates between the two groups were similar.
Conclusion: There were no significant differences in the clinical outcomes or radiographic improvements of both fusion methods in the treatment of adult isthmic spondylolisthesis. An autograft excised from a complete posterior arch containing a facet joint for interbody fusion is effective and affordable for treating isthmic spondylolisthesis.

1. Introduction

Posterior lumbar interbody fusion (PLIF) and internal fixation are widely used for treating lumbar spondylolisthesis and have shown good therapeutic effects [1,2]. Autografts and interbody cages are used in PLIF. The spinous process, lamina, and facet joint obtained from decompressive surgical resection are good graft materials for PLIF [3,4], and while the use of a cage can provide better anterior interbody support than a simple autograft, it is more expensive.

Kai et al. [3] found that the use of a bone graft containing an autologous facet joint not only can provide good anterior support but also can achieve good radiographic fusion (92.9%) and clinical results. The method described by Gill et al. for spinal decompression is the most common decompression method used for lumbar isthmic spondylolisthesis [5]. Bone resulting from a complete resection of the posterior arch using this decompression method can be cut into an autograft bone that contains the facet joint structure and morselised bone appropriate for interbody fusion. However, whether a strut autograft that contains this trimmed facet joint can produce the same clinical and radiographic outcomes as a cage interbody fusion remains unclear. Many alternative materials have been explored for use as a grafting material, such as titanium cylinders, carbon fibre cages, tantalum blocks, and polyetheretherketone (PEEK); however, PEEK cages are currently the most available and most widely used. We conducted a retrospective study comparing a local facet joint autograft alone and PEEK+ autograft in PLIF with pedicle screw internal fixation for

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Table 1
Patient data.

Data	Group A	Group B
Number of patients	44	40
Male:female	20:24	19:21
Age (years)	42.8 (26–68)	43.5 (20–65)
Body mass index	24.5 ± 4.2	23.9 ± 3.9
Smoking(Yes:No)	15:29	14:26
Slip level (L3:L4:L5)	3:26:15	3:25:12
Slip grade (I°:II°)	23:21	22:18
Follow-up period (months)	39.9 (24–60)	40.8 (24–64)

the treatment of adult lumbar isthmic spondylolisthesis in order to evaluate the clinical and radiological outcomes.

2. Materials and methods

2.1. General information

In total, 122 patients with single-segment lumbar isthmic spondylolisthesis who were treated with PLIF in the Spine Surgery Department of our hospital from January 2009 to January 2013 were selected for this retrospective study. Our institution's ethics committee approved the study. The operative indications included disabling back pain and/or lower extremity pain with or without neurological symptoms refractory to at least 3 months of aggressive conservative treatment. We excluded 32 patients exhibiting a high grade of slippage (grade III or IV) or who underwent revision spine surgery at the same level. Six of the remaining 90 patients were also excluded because of incomplete medical data. Thus, 84 of the 122 patients (69%) (39 men, 45 women) were included in the data analysis; the average follow-up period was 40 months (24–64 months). Patients were divided into two groups for PLIF: group A, with a local facet joint autograft alone (n = 44); and group B, with PEEK + autograft (n = 40). As the cage was not covered by medical insurance in our department, patients were selected for the two groups based on their financial status and preference. The baseline characteristics of the two groups were similar (Table 1).

2.2. Surgical method and postoperative treatment

All operations were performed by the two authors of this paper (Wang and Cao). Using the posterior midline approach, the spinous process, lamina, facet joints, and the root of the transverse process were routinely exposed. The posterior arch was completely excised en bloc by Gill's spinal decompression method. The superior articular process of the lower vertebra and the hyperplastic scar tissue in the arch isthmus were excised, and the nerve root was fully exposed. Under direct vision, four pedicle screws (Stryker Spine S.A.S, Cestas, France) were inserted into the slip segment. A C-arm X-ray machine was used to determine and adjust the depth of the screws, and then the disc space was gently distracted between the adjacent pedicle screws using a lamina spreader. The intervertebral disc and the cartilage endplate were removed using pituitary rongeurs and curettes. After the decompression and complete discectomy, maximal disc distraction and annular tension were obtained by inserting a disc spreader. For patients in group A, the posterior arch was first trimmed according to the intervertebral space height into two, 8- to 12-mm strut grafts that contained the facet joint (Fig. 1), and the remaining part was trimmed into morselised bone. For patients in both groups, the morselised bones cut from the autologous spinal process, lamina, and facet joint were first placed into the anterior portion of the intervertebral space and compacted. Then, for patients in group A, the strut bone was inserted. For patients in group B, two cages (PEEK cage, Stryker) loaded with autologous bone fragments were inserted (Fig. 1). After verifying the absence of nerve compression, the construct was secured with pedicle screw instrumentation. The patients began to walk three to four days after the surgery with a brace, which was worn for 3 months in both groups.

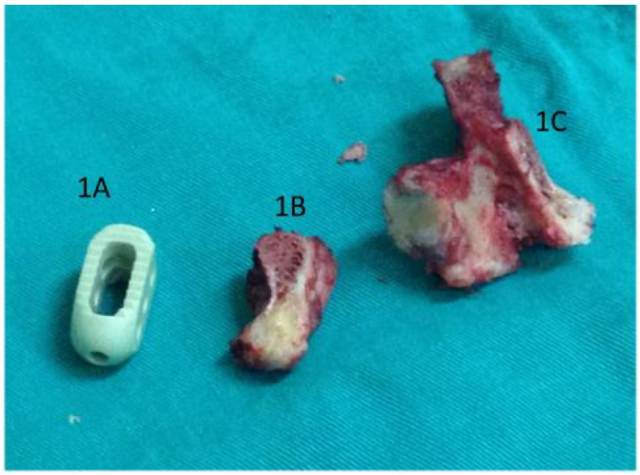

Fig. 1. 1A: Cage. 1B: Facet joint-containing strut autograft. 1C: Remaining posterior arch.

2.3. Follow-up, clinical efficacy, and radiological evaluations

The patients underwent routine outpatient evaluations at 3, 6, 12, and 24 months after the surgery and then at one-year intervals thereafter. Meanwhile, postoperative complications, nerve damage, and the recovery status were recorded. Back and leg pain before the surgery and at the last follow-up examination were assessed using visual analogue scale (VAS) scores (0–10 points). The lumbar dysfunction scale (Oswestry disability index (ODI); (0%–100%)) was used to evaluate the clinical improvements and daily function status of patients [6]. An overall evaluation of the operation was performed by patients at the last follow-up evaluation using the Kirkaldy-Willis criteria [7].

Two independent radiologists who were blinded to the patients' clinical data made the radiographic measurements and assessed the fusion status in each case. The degree of slippage and its reduction were assessed preoperatively and at the last follow-up evaluation, respectively, using the Taillard index; the relative slipping distance of the slipped lower vertebra and the horizontal length of the upper vertebra were observed using a lateral plain radiograph. To determine whether the facet joint that contained a strut autograft exhibited anterior interbody support, the preoperative and one-week, six-month, one-year, and two-year postoperative anterior and posterior disc heights (ADHs and PDHs) were measured with lateral lumbar radiographs obtained with the subject in an upright position (Fig. 2). To exclude the impact of differences in radiograph magnification among the different patients, the anterior and posterior disc height ratios (ADHRs and PDHRs) were used; these consisted of the ratios of the measured ADH and PDH to the diameter of the superior endplate of the next vertebra. Fusion status was assessed at the last follow-up evaluation using lumbar spine anteroposterior, lateral, flexion and extension radiographs. Solid fusion were considered to have occurred in the fusion segment according to the following criteria: the flexion-extension radiographs showed that the movement between the segments was <5°; there was bridging bone formation over the involved disc space, and no translucent band was present around the cage or intimate contact between the cage and the end plates [8,9]. The two radiologists could not reach a consensus regarding the fusion status in some patients; in these cases, agreements were reached through