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Nonoperative Treatment of Thoracic and Lumbar Spine Fractures: A Prospective Randomized Study of Different Treatment Options

Agnita Stadhouder, MD,* Erik Buskens, MD, PhD,†‡ Diederek A. Vergroesen, MD,§ Malcolm W. Fidler, MS, FRCS,¶ Frank de Nies, MD,‖ and F. C. Öner, MD, PhD*"
of anterior height, with less than 30% reduction of the spinal canal, and without signs of posterior element involvement were included.

There were 133 patients: 72 (54.1%) women and 61 (45.9%) men. Patients were admitted to hospital after initial radiographs had been made. A computed tomography scan was performed within 48 hours of admission in all cases. The fractures were classified according to the AO classification, and the severity of trauma, high or low energy, was also assessed. Bed rest was prescribed for the first 3–5 days depending on pain and general condition. After written informed consent had been given, patients were randomized to one of the following treatments for compression fractures: (1) physical therapy alone for 6 weeks, (2) thermoplastic removable brace for 6 weeks, and (3) plaster of Paris (POP) cast for 6 or (4) 12 weeks. For burst fractures, thermoplastic removable brace was compared with POP cast, both for 12 weeks. All patients treated with orthoses also received physical therapy, and in the compression group, braces were allowed to be removed at night. Discharge followed after adequate mobilization.

Table 1 shows the demographic data of the patients after randomization into treatment groups.

Follow-up was planned at 6 and 12 weeks and 6 and 12 months with at least 1 long-term follow-up visit minimally 1 year later. Initially, the study focused also on radiological parameters: 5 measurements were made on the supine lateral radiographs, that is, the C1 (actual Cobb angle) parameters: 5 measurements were made on the supine lateral radiographs, that is, the C1 (actual Cobb angle) between the superior end plate of the vertebrae above and the inferior end plate of the vertebrae below the fractured level; the C2, which is the wedge angle of the affected vertebra; the C3 measuring the wedge angle of the fractured vertebra and adjacent intervertebral discs of the fractured vertebra; the C4, which is the ratio between the heights of the anterior and posterior parts of the vertebral body; and the C5 angle, which includes the fractured vertebra and the superior intervertebral disc (Fig. 1).

Radiologic deformity, residual pain, and functional outcome were set as primary outcome parameters. At follow-up, patients were also asked about any pretrauma back pain and disability. At the long-term follow-up visit, Visual Analogue Scores (VAS) were used to assess toleration of treatment (0 = easily tolerated, 100 = intolerable) and residual pain (0 = no pain, 100 = unbearable pain), and an Oswestry Disability Index (ODI) was calculated.16

Because the majority of the fractures occurred at the thoracolumbar junction (T11–L2), we also evaluated these patients separately. In addition, analyses were repeated after exclusion of postmenopausal patients because this may be an independent parameter.

A power analysis beforehand was performed on the basis of a presumed difference in kyphosis angle of 5 degrees as significant difference (alpha 0.05, beta 0.20, SD 10), which required 22 patients per group. Statistical analyses were performed with SPSS 11.0 (SPSS Inc, Chicago, IL) to compare the different treatment schemes; compression and burst fractures were analyzed separately. Using an independent sample t test, mean differences in C measurements, VAS, and ODI between 2 treatments at a time were determined at follow-up inclusive of 95% confidence intervals (CI). Post hoc analyses were not conducted. A P value of less than 0.05 was considered significant. Power and sample size calculation was performed. In addition, possible prognostic factors for persistent back pain and disability were looked for with multivariate analysis.

### RESULTS

In total, there were 133 patients: 108 compression fractures, 22 burst fractures, and 3 patients with both compression and burst fractures. Patients who had both compression and burst fractures were allocated to the burst fracture group, making a total of 25 patients in this group (Table 1).

Table 2 shows the number of fractures, subdivided according to the AO classification, in each treatment group. The “split” (A2.2) fractures were included with the compression fractures for treatment as, regarding their severity, they seemed more like these than like the burst fractures. One B1.2 fracture was included in the burst fracture group because there was only minimal posterior disruption. Twenty patients had 2 compression fractures, 1 patient 2 burst fractures, 2 patients a compression and burst fracture and, 1 patient 2 compression fractures and 1 burst fracture. This gave a total of 158 thoracic and lumbar spine fractures: 132 were compression fractures (A1/A2) and 26 were burst fractures (A3+B1).

The fracture level varied from Th3 to L5, 74% of the fractures were at the thoracolumbar junction (T11–L2), 15% exclusively thoracic, and 11% lumbar localized.

### TABLE 1. Patient Demographic Data

<table>
<thead>
<tr>
<th></th>
<th>Compression Fractures</th>
<th>Burst Fractures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Brace for 6 Wk</td>
</tr>
<tr>
<td>No. patients (%)</td>
<td>108</td>
<td>29 (27)</td>
</tr>
<tr>
<td>Gender—male, %</td>
<td>45</td>
<td>48</td>
</tr>
<tr>
<td>Mean age, yrs (range)</td>
<td>47 (18–76)</td>
<td>50 (21–70)</td>
</tr>
<tr>
<td>Male</td>
<td>43 (18–75)</td>
<td>47 (21–70)</td>
</tr>
<tr>
<td>Female</td>
<td>51 (20–76)</td>
<td>52 (24–70)</td>
</tr>
<tr>
<td>Mean admission time, d</td>
<td>8.8 (0–60)</td>
<td>9.7 (0–60)</td>
</tr>
<tr>
<td>High-energy trauma, %</td>
<td>82</td>
<td>86</td>
</tr>
</tbody>
</table>

*Statistically significant.

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For compression fractures, there were no significant differences regarding sex, age, high-energy trauma, and admission time between the different treatment schemes. For patients with burst fractures treated with a brace, the mean ages of men (36 years) and women (57 years) showed a significant difference with a mean difference of 21.7 years and a CI of 1.8–41.5, as women were older than men (n = 9).

Twenty-seven women (38%) were postmenopausal with a mean of 10.4 years (range 0–30 years) between menopause and fracture. Twenty-one (78%) of these women did have a high-energy trauma, and they were all equally distributed among treatment groups ($\chi^2 P = 0.25$).

Thirty-two patients (24%), when asked, reported pretrauma episodes of back pain, only 2 patients actually had elevated ODIs at 7 and 20 at the time of admission, the remainder did not. Although planned follow-up was at 6 and 12 weeks and 6 and 12 months and long-term follow-ups in 1998 and 2003, not all patients attended on all occasions. In 1998, a clinical and radiological long-term follow-up was carried out on 67.4% of the patients. At this time, 2 patients had died of unrelated causes and could not be included in the follow-up. In 2003, by means of telephone calls and questionnaires, follow-up was possible in 61%, corrected for the 14 patients who, by then, had died. Eleven patients who could not be traced in 1998 were contacted in 2003. Using a paired sample $t$ test, we compared the VAS and ODI scores from 1998 with those from 2003 and concluded that there were no significant differences. We therefore combined the scores from 1998 and 2003 for the VAS and ODI for long-term follow-up. This gave a long-term follow-up percentage for 1998/2003 of 75.4%. The mean follow-up period was 7.11 years with a range of 1–12 years (SD 3.0).

Radiologic Measurements

Table 3 shows the mean C measurements made on the lateral radiographs directly after the trauma, 1 year later, and at the first long-term follow-up in 1998. The mean measurements and individual treatment methods are presented. There were no significant differences between treatment groups at trauma, 1-year follow-up, and follow-up in 1998, also because of the large SDs. Within each treatment group, the kyphosis measurements at trauma and follow-up did not show any significant differences; in particular, there was no deterioration of the kyphosis angles.

VAS and ODI Scores

For the treatment of compression fractures, physical therapy was tolerated better than a POP for 6 and 12 weeks (mean difference 33.9, CI of 16.6–51.3, calculated power 0.97; mean difference 21.6, CI 3.4–39.8, calculated power 0.81). Brace therapy was tolerated better than a POP for 6 weeks with a mean difference of 21.6 less on the VAS scale (CI 5.8–37.4, calculated power 0.77) (Fig. 2).

For the VAS score for residual pain, a brace was significantly better than a POP for 12 weeks (mean difference 19.0, CI 1.87–36.2, calculated power 0.60) (Fig. 3).

The ODI showed a significant difference in favor of brace therapy compared with a POP for 12 weeks (mean difference 10.1, CI 0.25–20.0, calculated power 0.57) and physical therapy (mean difference 14.9, CI 2.7–27.1, calculated power 0.70) (Fig. 4). These significant differences are summarized in Table 4.

When only patients with compression fractures of the thoracolumbar junction (n = 79) were analyzed, there were no significant differences regarding toleration of treatment. The VAS for residual pain was significantly lower after brace therapy compared with POP for 12 weeks (mean difference 28.1, CI 10.5–45.8) and POP for 6 weeks compared with POP for 12 weeks (mean difference 28.4, CI 9.6–47.3). The ODI was significantly lower after brace therapy than after physical therapy only (mean difference 26.9, CI 11.4–42.3), POP for 6 weeks (mean difference 7.7, CI 0.35–15.0) and POP for 12 weeks (mean difference 14.4, CI 0.63–26.1). Also, there was a significant difference in favor of POP for 6 weeks.

### Table 2. Treatment Randomization and Fracture Classification (AO), and Total Number of Fractures

<table>
<thead>
<tr>
<th>AO</th>
<th>A1.1</th>
<th>A1.2</th>
<th>A1.3</th>
<th>A2.1</th>
<th>A2.2</th>
<th>A3.1</th>
<th>A3.2</th>
<th>A3.3</th>
<th>B1.2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical therapy</td>
<td>4</td>
<td>30</td>
<td>1</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>36</td>
</tr>
<tr>
<td>Brace for 6 wk</td>
<td>2</td>
<td>28</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>32</td>
</tr>
<tr>
<td>POP for 6 wk</td>
<td>1</td>
<td>29</td>
<td>2</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>33</td>
</tr>
<tr>
<td>POP for 12 wk</td>
<td>1</td>
<td>28</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>31</td>
</tr>
<tr>
<td>Brace for 12 wk</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>6</td>
<td>—</td>
<td>—</td>
<td>10</td>
</tr>
<tr>
<td>POP for 12 wk for burst fracture</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>115</td>
<td>7</td>
<td>2</td>
<td>11</td>
<td>10</td>
<td>4</td>
<td>1</td>
<td></td>
<td>158</td>
</tr>
</tbody>
</table>
compared with physical therapy (mean difference 19.2, CI 3.8–34.7) (Table 5).

After excluding postmenopausal women from the total compression fracture population (n = 81), physical therapy was tolerated better than a POP for 6 weeks (mean difference 28, CI 4.8–52.5). The VAS for residual pain did not show significant differences. The ODI was significantly lower for brace therapy compared with physiotherapy (mean difference 19.1, CI 3.3–35.0), a POP for 6 weeks (mean difference 8.8, CI 0.65–17) and a POP for 12 weeks (mean difference 13.9, CI 2.8–24.9) (Table 6).

For burst fractures, the VAS and ODI scores were both worse than those for the compression group and did not show any significant differences between treatments.

In the compression fracture group, 20 patients (18%) had a VAS score for persistent pain of greater than 50 (moderate pain), and 10 (9%) of these had a VAS score of >70, which implies severe pain. Twelve patients (11%) in

| TABLE 3. Mean Measurements Compression and Burst Fractures (degrees) |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                | Compression Trauma | 1 Yr Last FU | Burst Trauma | 1 Year Last FU |
| C1 mean (SD)   | 7.7 (11.9)        | 9.3 (14.1)     | 7.2 (10.8)   | 11.8 (8.4)      | 8.3 (12.3)       | 11.8 (9.5)      |
| Physiotherapy  | 6.8 (13.6)        | 7.9 (10.2)     | 3.8 (17.5)   | Brace 12        | 12.6 (6.2)       | 9.5 (10.4)      | 12.3 (10.8)    |
| Brace          | 6.4 (14.6)        | 12.0 (14.0)    | 7.9 (12.9)   | POP for 6 wk    | 11.2 (10.0)      | 7.5 (13.8)      | 11.2 (9.1)     |
| POP for 6 wk   | 9.4 (9.6)         | 10.6 (10.5)    | 8.7 (11.0)   | POP for 12 wk   | —                | —               | —              |
| POP for 12 wk  | 8.3 (8.9)         | 9.3 (21.2)     | 7.7 (11.4)   | POP for 12 wk   | —                | —               | —              |
| C2 mean        | 9.9 (5.2)         | 12.3 (7.3)     | 11.0 (6.0)   | C2 mean         | 12.2 (7.1)       | 13.2 (6.9)      | 11.8 (6.1)     |
| Physiotherapy  | 9.1 (6.0)         | 10.1 (12.4)    | 9.5 (8.1)    | Brace 12        | 13.2 (4.2)       | 15.0 (6.6)      | 10.6 (7.9)     |
| Brace          | 10.5 (4.5)        | 14.2 (5.8)     | 11.6 (5.1)   | POP for 6 wk    | 11.4 (9.1)       | 12.0 (7.1)      | 13.3 (2.6)     |
| POP for 6 wk   | 9.9 (5.6)         | 11.9 (5.2)     | 11.5 (5.2)   | POP for 12 wk   | —                | —               | —              |
| POP for 12 wk  | 10.1 (4.7)        | 12.0 (4.4)     | 10.4 (5.4)   | POP for 12 wk   | —                | —               | —              |
| C3 mean        | 3.1 (9.6)         | 4.0 (11.7)     | 2.0 (11.8)   | C3 mean         | 5.9 (6.4)        | 4.3 (7.3)       | 4.0 (7.0)      |
| Physiotherapy  | 2.4 (13.4)        | 1.5 (8.8)      | –1.4 (16.1)  | Brace 12        | 4.3 (7.3)        | 4.0 (9.5)       | 5.0 (7.2)      |
| Brace          | 2.3 (7.2)         | 5.2 (8.1)      | 3.9 (8.6)    | POP for 6 wk    | 7.4 (5.4)        | 4.5 (5.9)       | 2.8 (7.2)      |
| POP for 6 wk   | 5.5 (8.0)         | 5.0 (10.9)     | 4.7 (10.0)   | POP for 12 wk   | —                | —               | —              |
| POP for 12 wk  | 2.7 (8.7)         | 6.8 (16.0)     | 0.8 (11.6)   | POP for 12 wk   | —                | —               | —              |
| C4 mean        | 0.8 (0.1)         | 0.7 (0.13)     | 0.8 (0.13)   | C4 mean         | 0.73 (0.14)      | 0.67 (0.18)     | 0.69 (0.17)    |
| Physiotherapy  | 0.78 (0.09)       | 0.72 (0.16)    | 0.77 (0.12)  | Brace 12        | 0.71 (0.10)      | 0.62 (0.19)     | 0.71 (0.23)    |
| Brace          | 0.77 (0.08)       | 0.68 (0.12)    | 0.71 (0.15)  | POP for 6 wk    | 0.75 (0.17)      | 0.71 (0.16)     | 0.67 (0.09)    |
| POP for 6 wk   | 0.78 (0.1)        | 0.74 (0.14)    | 0.74 (0.11)  | POP for 12 wk   | —                | —               | —              |
| POP for 12 wk  | 0.76 (0.15)       | 0.70 (0.17)    | 0.78 (0.12)  | POP for 12 wk   | —                | —               | —              |
| C5 mean        | 7.7 (7.3)         | 10.4 (9.6)     | 8.6 (9.5)    | C5 mean         | 10.3 (7.2)       | 11.6 (8.3)      | 9.2 (6.7)      |
| Physiotherapy  | 8.8 (9.7)         | 9.8 (7.0)      | 6.2 (13.3)   | Brace 12        | 9.0 (5.5)        | 12.6 (7.9)      | 8.1 (8.6)      |
| Brace          | 5.5 (5.3)         | 11.1 (6.9)     | 9.6 (7.1)    | POP for 6 wk    | 11.5 (8.5)       | 10.9 (8.9)      | 10.3 (3.9)     |
| POP for 6 wk   | 8.6 (5.9)         | 10.0 (9.1)     | 9.9 (8.0)    | POP for 6 wk    | —                | —               | —              |
| POP for 12 wk  | 7.6 (6.9)         | 10.9 (14.6)    | 8.2 (9.0)    | POP for 12 wk   | —                | —               | —              |

FU, follow-up.

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FIGURE 2. Compression fractures, all patients: mean VAS toleration of treatment (0 = easily tolerated, 100 = intolerable).

FIGURE 3. Compression fractures, all patients: mean VAS residual pain.
and Dai and Jin

Volume 23, Number 8, September 2009

If we had restricted our measure-

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All Patients With Compression Fractures, Except

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classification are the most accurate. The

also

where burst fractures were reduced before application of

who concluded that they did not see

TABLE 4. Compression Fractures, All Patients; Summary of Significant Differences Between Treatments: Cross Table

<table>
<thead>
<tr>
<th></th>
<th>Physical Therapy</th>
<th>Brace</th>
<th>POP for 6 Wk</th>
<th>POP for 12 Wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical therapy</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Brace</td>
<td>ODI</td>
<td>---</td>
<td>ODI</td>
<td>---</td>
</tr>
<tr>
<td>POP for 6 wk</td>
<td>---</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>POP for 12 wk</td>
<td>---</td>
<td>---</td>
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<td>---</td>
</tr>
</tbody>
</table>

the compression fracture group had ODI scores of >40; 8 of

these with an ODI of 60–80 and 1 with an ODI of 80–100. A

multivariate analysis did not show any significant relationship

with the type of treatment, fracture classification, or C

measurements on the lateral radiographs. Prognostic factors of

poor outcome could therefore not be identified.

In the burst fractures group, no patient had a VAS pain

score higher than 70; 3 patients (12%) had a VAS score >50.

One patient (4%) in the burst fracture group had an ODI

of 76%. Multivariate analysis did not reveal significant prognostic

parameters.

One patient in the burst group treated with a brace was

operated on because of progressive deformity and pain 2 years

after the traumatic event.

DISCUSSION

The first part of this study considered possible alterations in the measurements of the traumatic kyphosis

after various treatments. Kuklo et al17 and Dai and Jin18

showed that the intra- and interobserver reliability of measurements on lateral radiographs and computed tomogra-

phy scans vary but the C1 measurement as used in our study

and the McCormack19 classification are the most accurate. The

Spine Study Trauma Group also included the Cobb angle (our

C1 measurement) and the anterior vertebral compression

percentage (our C4 measurement), and the sagittal to transverse canal diameter ratio in their list of recommended measurements for assessing thoracolumbar fractures.15 If we had restricted our measurements to these recommended ones, our results would not have been different.

Our observation that nonoperative treatment, using the

methods described, does not significantly improve or, and

more importantly, lead to deterioration in the final kyphosis

angle is in agreement with the findings of Ohana et al20 and

Folman and Gepstein,21 who treated patients with compression

fractures functionally or with a brace. Alany et al,1 Agus

et al,7 and Wood et al22 who investigated burst fractures treated

nonoperatively, came to the same conclusions as did Tropiano

et al10 where burst fractures were reduced before application of

the cast.

The VAS and ODI scores were more revealing. For

patients with compression fractures, the scores of all the

patients, of just those with thoracolumbar fractures, and of all

patients after exclusion of the postmenopausal women

indicated that the best of our treatment options is a brace

for 6 weeks; for burst fractures, there was no difference

between a brace or a POP. We did not separately analyze the

results for the 2 groups of patients with fractures above T11 or

below L2, as the numbers would have been too small.

These results are in contrast with Ohana et al20 and

Folman and Gepstein21 who concluded that they did not see any difference in outcome between patients treated with

a brace or functionally with physical therapy. Braun et al8 also
did not see a difference in outcome of patients treated

functionally or with a 3-point brace. The difference in results

may be explained by the retrospective nonrandomized nature

of their studies compared with ours.

We wondered why for patients with compression

fractures, brace treatment was better than a POP? Perhaps

a removable brace provided the optimal combination of

support, exercise, and comfort; in other words, the brace gave

the patient sufficient spinal support, reduction of discomfort,

and confidence to encourage exercise during the day while

removal of the brace at night facilitated sleep and a feeling of

general well-being.

The scores also showed disturbing features. According to

the VAS, 20 (18%) of the 108 patients with compression

TABLE 5. Patients With Thoracolumbar Junction Compression Fractures; Summary of Significant Differences Between Treatments: Cross Table

<table>
<thead>
<tr>
<th></th>
<th>Physical Therapy</th>
<th>Brace</th>
<th>POP for 6 Wk</th>
<th>POP for 12 Wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical therapy</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Brace</td>
<td>ODI</td>
<td>---</td>
<td>ODI</td>
<td>---</td>
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<tr>
<td>POP for 6 wk</td>
<td>---</td>
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<td>---</td>
</tr>
<tr>
<td>POP for 12 wk</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

TABLE 6. All Patients With Compression Fractures, Except Postmenopausal Women; Summary of Significant Differences Between Treatments: Cross Table

<table>
<thead>
<tr>
<th></th>
<th>Physical Therapy</th>
<th>Brace</th>
<th>POP for 6 Wk</th>
<th>POP for 12 Wk</th>
</tr>
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<tr>
<td>Physical therapy</td>
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<td>---</td>
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</tr>
<tr>
<td>Brace</td>
<td>ODI</td>
<td>---</td>
<td>ODI</td>
<td>---</td>
</tr>
<tr>
<td>POP for 6 wk</td>
<td>---</td>
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<td>---</td>
</tr>
<tr>
<td>POP for 12 wk</td>
<td>---</td>
<td>---</td>
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</tr>
</tbody>
</table>
We included patients with a thoracic or lumbar fracture, of whom 74% had a fracture of the thoracolumbar junction. The numbers of exclusively thoracic or lumbar fractures were too small to split our patient population in 3 groups. However, the number of patients with a fracture of the thoracolumbar junction was sufficient for separate analysis; brace therapy significantly had the best outcome on the ODI compared with the other treatment modalities.

Despite the fact that our study shows some methodologic flaws, it is one of the few studies that compares nonoperative treatment schemes based on a reasonable number of patients. A prospective, probably multicenter, study with inclusion of a sufficient number of patients would seem appropriate to search for the possible factors predicting poor outcome.

CONCLUSIONS

None of our nonoperative treatments had an effect on the post-traumatic kyphosis measurements. After a compression fracture, physical therapy alone is the most easily tolerated treatment. Brace treatment, however, results in the least residual pain and the least disability on the long term. Despite the fact that our study has some drawbacks, we tentatively recommend brace treatment as the treatment of choice for patients with moderate compression fractures of the thoracic and lumbar spine. For burst fractures, neither treatment had a clear advantage.

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fractures suffered from moderate or severe back pain at long-term follow-up; 12 patients had an ODI score greater than 40 indicating moderate disability. Of the 25 patients with burst fracture, 3 (12%) had chronic moderate pain and one more was operated on because of severe persistent pain. Such chronic pain after the nonoperative treatment of thoracolumbar fractures has also been observed by other authors where treatments have varied from several weeks bed rest, different braces, and physiotherapy to supervised neglect.2–6,9,21,23

The multivariate analysis of our results unfortunately did not reveal any prognostic factors for persistent pain and disability. In particular, there was no association between final kyphosis measurements and residual pain, a fact that has also been noted by various other authors.6,23–25 although Gertzbein26 observed that a kyphotic deformity of greater than 30 degrees at 2-year follow-up was associated with an increased incidence of significant back pain. Folman and Gepstein studied 85 patients with a thoracolumbar vertebral wedge fracture treated with either physical therapy or a 3-point brace and found that 69.4% of the patients complained of chronic back pain, although there was no difference between the 2 nonoperative treatments.21 The mean ODI for this patient group was 56.3, which is considerably higher than that of our population. He found a weak correlation between pain intensity and local kyphosis angle.

We should consider seriously the relatively high incidence of persistent pain, disability, and dissatisfaction after these relatively “minor” spinal injuries.27 This incidence is much higher than seen after comparable injuries to the extremities. Almost 20% of patients suffering moderate to severe pain after a minor injury of the ankle, knee, or wrist would not be accepted as “good results.” We should ask ourselves how we can predict these unsatisfactory results and whether we can prevent disability.

This study did have some drawbacks. First, the recruitment of patients was slow, 133 over almost 6 years, and this lead to a relatively small number of patients in each group, especially in the burst fracture group. However, these numbers were sufficient to show that there were no treatment-related statistically significant differences between the kyphosis measurements at the long-term follow-up and also to show that there were significant differences for the VAS and the ODI scores in the compression group. Second, patient compliance was not optimal, although the patients were well informed. The combined attendance at the long-term follow-up was 75%. We feel, however, that this has not resulted in a systematic bias because the random absentee applied equally to all groups. Third, patients’ toleration of treatment, persistent pain, and disability were only recorded at the long-term follow-ups and not at the earlier controls as well, when they might have provided insight into how quickly patients could function independently after various treatments of a spinal fracture. Fourth, the percentage of postmenopausal women is relatively high and osteoporosis may have influenced the results. However, almost 80% of them had a high-energy trauma, and none of them had spontaneous back pain at inclusion; this probably excludes any true “spontaneous” osteoporotic fractures. Separate analyses also showed that the ODI was significantly better for brace therapy after exclusion of postmenopausal women.


