Measurement of vertebral rotation in idiopathic scoliosis using the Perdriolle torsionmeter: a clinical study on intraobserver and interobserver error

Summary This study was designed to determine the reliability and accuracy of the Perdriolle torsionmeter. Fifty-four observers were divided into three groups according to their previous experience in the field of orthopaedics and the treatment of scoliosis. Each observer, on two separate occasions, measured the apical vertebral rotation on preoperative and postoperative roentgenograms of three idiopathic thoracic scoliotic curves using the torsionmeter. For all groups, there was no statistically significant difference (P > 0.05) between the average of the first and the average of the second measurements of vertebral rotation of any of the curves. In the curve with the highest frontal Cobb angle and vertebral rotation of more than 30°, there was a statistically significant difference (P = 0.03) between the average measurements of the three groups of observers. We concluded that, as both intraobserver and interobserver error risks were insignificant, the torsionmeter can be accurately used by everyone in the fields of orthopaedics provided the vertebral rotation is not greater than 30° and the curve is mild or moderate. The reliability and accuracy of the torsionmeter was found to be questionable at more than 30° of vertebral rotation because of increased risk of interobserver error.

Key words Idiopathic scoliosis · Vertebral rotation · Torsionmeter

Introduction Scoliosis is defined as a habitual lateral displacement of the vertebral body line from its normally symmetric alignment in the mid sagittal plane. It usually involves other asymmetries of the spine in the frontal, sagittal and transverse planes [11]. As a result of this, three-dimensional measurement is essential for fully understanding the course of the deformity. The radiographic determination of transverse plane deformity is an important component of scoliosis assessment. The first well-known studies into radiographic measurement of vertebral rotation focused on measuring the position of the tip of the spinous process or pedicle shadow displacement in relation to the underlying vertebral body [6]. Several methods have now been developed for measuring vertebral transverse plane angulation or vertebral axial rotation. The torsionmeter (Tasserit-Callemiers, Gron, France), developed by Perdriolle [8], is still one of the most widely used methods.

This study aimed to determine the reliability and accuracy of the Perdriolle torsionmeter by investigating the measurements of randomly selected observers. We tried to answer the question: “Could even a beginner in orthopaedics use this device as perfectly as an experienced spine surgeon?”. 

Materials and methods Preoperative and postoperative anteroposterior roentgenograms of three patients who had idiopathic thoracic scoliosis and had been treated surgically with Isola spinal instrumentation were selected for making the measurements (Table 1).
In order to establish the level of intraobserver error, we compared the averages of the final measurements of each group for each of the six curves. It was seen that there was no statistically significant difference (P > 0.05) between the averages of the final measurements of the three groups for five of the curves. However, for the curve that had the highest frontal Cobb angle and the most rotated apical vertebra (patient 3, preoperative roentgenogram), a significant statistical difference (P = 0.03) between the averages of the final measurements of group A, group B and group C was found (Table 3). The average of all the vertebral rotation measurements of this curve was 34.44 ± 1.51°. In the curve (patient 2, preoperative roentgenogram) that had the second highest frontal Cobb angle and an average value for vertebral rotation of more than 30°, there was no statistically significant difference between the average final measurements of groups A, B and C (P = 0.40).

### Discussion

An ideal instrument for measuring vertebral rotation should be: cheap, non-invasive, quick to use, accurate and reliable and easily used by everyone in orthopaedics.

It has always been accepted that the Perdriolle torsionmeter is cheap, non-invasive and not time consuming [1, 4, 5]. However, controversy remains regarding its reliability and accuracy because of uncertainties about the effects of variable vertebral geometry [12]. In a clinical study performed by Dincer et al. [4], the Perdriolle torsionmeter was found to be as reliable and accurate as computer tomography in thoracic segments but not in lumbar segments because of their higher vertebral rotation. Barsanti et al. [1] reviewed the torsionmeter and concluded that it was an effective way to measure vertebral rotation. They added that the larger measurement errors were made in trying to measure rotations above 35°. Gunzburg et al. [5] reported that the torsionmeter was the easiest and most accurate of the various measuring methods, at least for vertebral rotations of up to 30° on an anteroposterior roentgenogram. Benson et al. [2] stated that determining vertebral rotation exactly from observation of pedicle shadow offset in a roentgenogram was impractical because different spines had different offsets for the same degree of rotation, and changes in frontal and sagittal inclinations of a single vertebra could alter its offset in the same manner as changes in rotation. Richards [10] found the torsionmeter to be undependable due to obstruction of landmarks by the metal implants, difficulties in the precise marking of the pedicle and further errors in measurement arising from rotation of the patient’s body during the radiographic examination.

All of these previous studies of the torsionmeter were based on measurements made by observers experienced in using this device. So far, the question “can everybody in orthopaedics use this device successfully?” has not been answered. Also, most of these studies were performed on dried human cadaver vertebrae. In our opinion, to evaluate the effectiveness of the torsionmeter, measurements should be made on preoperative and postoperative roentgenograms of scoliotic patients.