



RESEARCH REPORT

Reassessing the accuracy and reproducibility of Diers formetric measurements in healthy volunteers



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Kyphosis;
Trunk torsion

Abstract *Background:* There is an urgent need for objective assessment of the result of osteopathic treatment. The non-invasive equipment Diers 4-D formetric[®], using the Moiré principle to estimate spine and pelvis configuration from the external aspect of the back, allows for the quantification of angles, surfaces, torsion and balance.

Objective: To assess the reproducibility and coefficient of variation of formetric 4D measurements in repeat assessments of healthy, asymptomatic persons.

Materials and methods: Repeat measurements were performed in an *initial group* of 38 volunteers by assessors with basic training, and in an *advanced group* of 113 persons by fully trained assessors, who have gone through a learning curve. Variables related to kyphosis, lordosis and trunk as well as pelvis torsion were measured, and results of the repeat measurements were analysed using appropriate statistics. Aside from estimating correlations between repeat measurements, Bland and Altman plots and receiver operating characteristic curve analysis were applied in order to quantify the inter-assay variability and the coefficient of variation.

Results: The kyphotic and lordotic angulations were higher in women than in men. In the initial group the correlation between the repeat measurements was satisfactory ($r = 0.49–0.55$), and there was no trend towards over- or underestimation

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between repeat measurements. However, the dispersion of the difference between the repeat measurements was relatively broad, resulting in a coefficient of variation of approximately 13–14% for the kyphotic and lordotic angulations. The reproducibility in the advanced group was clearly better with coefficients of variation of approximately 7% for angulations of kyphosis and lordosis, as well as for pelvic inclination. In contrast, the reproducibility of estimates of torsion was poor.

Conclusion: The examinations using the Diers 4-D formetric system must be performed with great care for exact positioning of the person, and require adequate training. The interpretation of the effect of treatment should take into account the variability between repeat measurements. Provided the technique is applied correctly, the reproducibility of results is excellent, making this non-invasive system appropriate for clinical trials.

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Implications for practice

- Many centres use the Diers 4d formetric system to assess the conformation of the thoraco-lumbar spine.
- The formetric system can estimate the effects of external factors and of particular treatments, such as in cases of idiopathic scoliosis.
- However, the accuracy of the system, when used in daily practice, needed further analysis, particularly regarding its reproducibility and variability of the outcome of repeated measurements in healthy, symptom-free persons.
- This information is of pivotal importance in view of evidence based osteopathic practice.

Introduction

One of the essential goals of osteopathic medicine is to restore optimal function of the body by treating the causes of pain and imbalance, primarily focusing on the vertebral column. However, there is an urgent need to estimate the effectiveness of osteopathic treatment and its outcomes.¹ This requires adequate, preferentially objective methods for diagnosis and for measuring treatment outcomes.² In addition to propaedeutic inspection, palpation and radiologic imaging, the non-invasive method by Diers formetric 4-D® has been promoted (Diers international GmbH, Schlangenbad, Germany) for the objective and quantitative measurement of spine statics and posture. This non-invasive method is based on the Moiré principle and reconstructs the anatomy of

the spine virtually from the external aspect of the back surface, and it calculates a number of numeric variables expressing torsion, angulation, asymmetry, etc. (<http://www.diers.de/template.aspx?page=4>).

The results obtained by the formetric system have been validated in comparison with conventional manual 2D method,³ ultrasound-guided spine analysis,⁴ and radiologic investigation of the spine.^{3,5} The system has been applied for the assessment of particular treatments such as in patients with idiopathic adolescent scoliosis,^{6,7} and for the study of the influence of professional mechanical risk.⁸

The accuracy of measurements by the Diers formetric equipment has been estimated using repeat observations and the inter-assay correlation has been calculated by Pearson statistics,^{9,10} and interclass correspondence.^{11,12} These investigations have concluded that the accuracy is high because of satisfactory statistical correlations.

The result of these statistical tests would be expected to be favourable since the same subjects were repeatedly assessed using the same equipment, by the same investigator, and in the same position.¹³

In the framework of quality assurance in osteopathic medicine the present study aimed at reassessing the reliability, accuracy and inter-assay reproducibility of the Diers system in a number of healthy volunteers, with emphasis on the coefficient of variation, and primarily focusing on the confidence limits of multiple variables. We also studied the influence of gender on the distribution of measured variables, as well as their mutual correlation. This information should ultimately permit a more valid estimation of the effect of different treatment approaches on spine statics.¹⁴

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