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Movement analysis of the sacroiliac joint part of the

Indication and treatment of adult spinal deformity

The INTRAKS-study



09.12.2020

Movement of the Sacroiliac (SI) Joint, comparing conventional RSA with the Sectra Implant Movement analysis using a low dose CT for high accuracy measurement

Abstract

Background: Radiostereometric analysis (RSA) is a high precision *in vivo* measuring method and regarded as the gold standard for motion analysis. RSA has been around for over 40 years and its accuracy is properly evaluated. The CT technics have evolved and now low dose CT scans can reproduce 3-D models of bone and joints. The Sectra Implant Movement analysis (IMA) is a new method using a low dose CT for high accuracy measurement. There is no study evaluating the precision and accuracy of the new CT based method. We want to compare the accuracy of the two methods.

Method/design: The RSA method will be tested in patients that already have tantalum markers inserted around the SI joints from earlier studies conducted at Ullevål University Hospital. There are two patients in the age of 40-50 years available for RSA analysis with and without provocation of the SI joints. Some are fused in one SI joint after insertion of the tantalum markers, but the contralateral joint can then be used for the analysis. At the same time, we will perform low dose CT with and without provocation of the SI joints. The results of the analysis will be compared.

Discussion: The conventional RSA is an invasive method using tantalum markers inserted in to bone. If the CT method has the same accuracy, then the tantalum markers will become obsolete and future studies can easily be performed using non-invasive low dose CT scans.

Keywords: RSA, CT method, low dose CT, IS joint, movement

Introduction:

Because of the high accuracy and precision, radiostereometric analysis (RSA), has become a well-established method for three-dimensional (3-D) measurements of micro motion in joints [1-6]. The implantation of tantalum markers is invasive, but no reports of patient injuries are reported. The markers might be inserted through the approach used during a surgical intervention or in an extra stab incisions in the skin to get the markers to the necessary position in the bony structures. The placements of the markers are of outmost importance to achieve good quality measurements. At least three non collinear markers in each segment and a good distance and distribution in all three axes (X, Z, Y) is essential for a good 3-D configuration.

The CT techniques have evolved and now low dose CT scans can reproduce 3-D models of bone and joints. The Sectra Implant movement analysis (IMA) [7-10] is a non-invasive method using a low dose CT scan. No tantalum markers are needed and joint provocation can easily be conducted in the CT. The CT scan is then sent to the Sectra AB for analysis.

Method:

Patients and methods:

The RSA method will be tested in patients that already have tantalum markers inserted around the SI joints from earlier studies [11, 12], approximately five years ago, conducted at Ullevål University Hospital. These are patients with long lasting severe sacroiliac joint pain. There are two patients in

the age of 40-50 years available for RSA analysis with and without provocation of the SI joints, at the same time we will perform low dose CT with and without provocation of the SI joints. For the non-provocation, the patient will be in a supine-position. The provocation x-ray/low dose CT will be performed; 1: anterior straight legraise 2: One side figure of four position, both with 1kg of load. Some are fused in one SI joint after insertion of the tantalum markers, but the contralateral joint can then be used for the analysis. We will also measure eventual movement in the fused joint and the symphysis (if tantalum markers present). The Center for Implant and Radiostereometric Research Oslo has extensive experience with RSA and established state of the art measuring method of movement in the SI joint. They will perform the RSA measurements. The CT scan is send to the Sectra AB for analysis.

Statistical analysis:

Null hypothesis (H0): There is no difference in the accuracy

Alternate Hypothesis (H1): There is a difference in the accuracy

Continuous variables will be described with mean and standard deviation\, and the normality of the data will be checked using the histograms, QQ-plots and the Kolmogorov-Smirnov-Test of normality. The differences of motion will also be tested for normality. The paired sample T-test will be used to detect possible significance in the difference between the two groups. Non-parametric tests are used if the assumption of normality does not hold. All analysis will be conducted using commercially available software (SPSS version 24, IBM Inc.) and the level of significance is set to $p < 0.05$ in a two-sided test.