

Visual inspection of the osteoporosis functional disability using rescaled standard anatomical pictures

Szczygieł A¹, Ciszek E¹, Górkiewicz M²

¹ Academy of Physical Education in Cracow, Faculty of Physical Therapy, Cracow, Poland

² Jagiellonian University of Cracow (Poland), Collegium Medicum, Institute of Public Health, Department of Epidemiology and Population Research, Cracow, Poland

Abstract

Purpose: This paper promotes use of a 3-dimensional computer-based digitizer to repeated scoring the osteoporosis functional disability of the patients during physiotherapy. The direct purpose is to present our research on the use of standardized anatomical pictures enabled by this technology. The novel method for judging the validity of scores drawn from visual inspection was proposed.

Material and methods: For each patient from group of 41 women menaced with osteoporosis the collection of four skeletal pictures was obtained. Two double-blinded scoring of these pictures were carried out by experienced physiotherapists. The statistical analyses were focused on probability (Pr) that scoring was made by random.

Results: It was proved that probability $Pr < 1$ significantly. Moreover, with maximum likelihood estimate (MLE) value of Pr was approximated as $Pr < 0.2$.

Conclusions: The visual inspection, carried out by comparing one standardized image with another, or one with many, offers there a good alternative to questionnaires used to examine health-related quality of life. Moreover, there measurements carried out with 3-dimensional digitizer can be used instead of (or as completion to) more expensive and more invasive measurements like radiography or ultrasonography.

Key words: osteoporosis, physiotherapy, visual inspection, non-invasive.

Introduction

The aims of an individual physiotherapy program should be formulated in terms of functional independency and recommended levels of physical activity or, more generally, in terms of health-related quality of life. In common use there are numerous questionnaires, in these strictly related to disability under study [1]. But it is known that adaptation of questionnaire or even a simple Likert scale to use them in other language or/and in other social environment constitutes a burdensome and long-time process, without any guarantee of a success [2]. The visual inspection, carried out by comparing one standardized image with another, or one with many, offers there a good alternative [3] on condition of keeping proper procedures for data acquisition and statistical analyses [4]. Before all, there the anatomical (histological) pictures should be distinguished from diagnostic ones. The latter need not be accurate in all details, but just opposite, they must allow the user to extract useful information. The practical problem was how prepare the anatomical images, which should be physiologically representative for examined patients as well as standardized for blinded comparisons. Authors recommended there data visualization approach used in the computer system Metrecom [5]. The main idea is to deal with basic three-dimensional anatomical model, which can be modifying accordingly to given patient's properties. In other words, the used algorithms are similar to that of the Chernoff faces [6], but they operate with three-dimensional surface [7] instead two-dimensional curves.

Material and methods

In the experiment the therapeutic group of 41 women were twice examined with Metrecom computer-based system. This instrument uses a touch probe that was placed on various palpated landmarks of the patient's body. The computer recorded positions of probe and then created 3-dimensional image in its memory, that can be used to display and print 2-dimensional pic-

ADDRESS FOR CORRESPONDENCE:

Andrzej Szczygieł
Academy of Physical Education in Cracow,
Faculty of Physical Therapy
Al. Jana Pawła II 78, 31-571 Kraków, Poland
e-mail: wrszczyg@cyf-kr.edu.pl

tures. There two quite different approaches may be taken to the subjective scoring of visual information. Under the traditional one the pictures were collected into patient's histories and the physiotherapists score each history separately from others. In this study the double blinded scoring was organized in a simple, uncomplicated way. First, all identification data about patients and time of measurements were hidden on the pictures. Then physiotherapists two times divided all collection of 82 pictures into 9 ordered classes of preference basing on his/her subjective, holistic opinion. The raw statistical material obtained in such way consists of two independent orderings of the same set (in our experiment: 82) pictures, what gives a good starting point to many classical statistical procedures like Sperman rank correlation, Kendall's coefficient of concordance, test of goodness-of-fit (e.g. chi-square) [8].

Results

Examined approach was shown practicable and valuable. Two session of a preferential ordering, separated with enough long relax, took together no more than 1-2 hours. The statistical analyses rejected hypothesis that scoring were by random with significance $p < 0.0001$. Moreover, with maximum likelihood estimate (MLE) value of random scoring was approximated as $Pr < 0.2$.

Discussion

It was obvious that radiography cannot be applied in repeated examinations during rehabilitation. The 3-dimensional computer-based digitizer dominates over other possible technologies with respect to time and expenditures necessary to obtain diagnostic material. Owing their low volume resulting digital information can be easy copied, transmitted, analysed and communicated in a lot different ways. Nevertheless, there

some serious doubts on an accuracy and validity of these data arose [5,9,10]. Our research showed adequate application area (it mean a supervising progress of rehabilitation in therapeutic group) and a proper procedure for data acquisition that makes all method reliable.

Conclusions

We have conducted experiment which confirmed our expectation in the matter and encouraged us to continue the research.

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