Assessment of Disease Severity (in Terms of Function) Using the Internet

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ABSTRACT. ***Objective.*** To determine whether visual analog scales (VAS) can be used over the Internet to assess the patient with ankylosing spondylitis (AS) accurately or if the use of this different medium will affect the results.

Methods. Patients with AS (n = 50) attending a physiotherapy/educational course completed both an Internet based and a paper based version of the Bath Ankylosing Spondylitis Functional Index (BASFI) that uses VAS. The Internet version was completed twice to assess intrarespondent variation reliability and compared with the paper version to assess interrespondent variation reliability. Patients were also asked to assess ease of use and to suggest changes to the Internet version.

Results. The interclass coefficient of intra- and interrespondent reliability were 0.989 ($p < 0.001$) and 0.976 ($p < 0.001$), respectively. There was a 3% difference in assessments carried out over the Internet compared to those on paper and a 2% difference in repeatability of Internet assessed questionnaires. Bland and Altman plots showed a mean difference between paper compared to the Internet version was 0.0156 with 95% limits of agreement at –1.07 to 1.03. More than half the participants reported that the Internet version was easier to complete than the paper version (96% rated usability as 1 on a scale of 1–10, with 1 being extremely easy and 10 being impossible).

Conclusion. Assessment of disease severity by VAS may be accurately carried out over the Internet. This means that the evaluation of disease status and the longterm followup of people in different countries and perhaps in different languages may now be possible, using the Internet. (J Rheumatol 2004;31:1819–22)

Key Indexing Terms:
ANKYLOSING SPONDYLITIS OUTCOME ASSESSMENT INTERNET SEVERITY

Access to the Internet is becoming more popular and readily available. Patients are now seeking and obtaining health information through the Internet more often than in the past. In a recent UK based study[1], 43% of patients attending a rheumatology clinic had access to the Internet. Of those who searched for medical information, 83% perceived the information as being useful and 31% found it easier than asking their doctor or nurse. They searched for information on their arthritis (83%), drug treatment (54%), and alternative therapies (31%). In a study in the USA[2] on private orthopedic patients, 20% had used the Internet to search for information on their diagnosis. Search rates were highest in patients with disorders of the spine[2].

The severity of many conditions such as ankylosing spondylitis (AS; which affects the spine in young people) can be evaluated by self-assessment. Currently, the disease activity of AS (i.e., pain, fatigue, stiffness, discomfort, tenderness) can only be assessed by self-report. These assessments could be carried out instantly and accurately over the Internet, resulting in considerable savings in time and expense (i.e., faster data, more accurate data entry, no photocopy of questionnaires, and no postage and packing costs).

Many self-assessment indices use visual analog scales (VAS) where the person places a mark on a line to show the level of severity of their symptoms. A computerized version of the Western Ontario and McMaster Universities VA3.0 Osteoarthritis Index has been validated[3]. We examined the repeatability, validity, and ease of Internet use compared to the gold standard of pen and paper for completion of the Bath Ankylosing Spondylitis Functional Index (BASFI)[5].

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MATERIALS AND METHODS

Patients. Patients (n = 50) with AS as defined by the New York criteria[4] who were attending a physiotherapy education program were asked to complete an Internet based and a paper based version of the BASFI. Instructions and set-up of the Internet page were identical to the paper version and participants were given no outside help or advice. This index is a validated and accepted index of function in AS. It uses 10 VAS to assess functional ability (i.e., the ability to look over your shoulder without turning your head, get up out of an armless dining room chair without using your hands or other help, put on socks without help or aids, etc.). Patients place a mark on the 10 cm line to show their ability to perform each function. The average of all the questions regarding function is used as the total functional score.

The Internet version required that the patient place the mouse on the area of the line representative of their functional level and click with the left side of the mouse. The line could be automatically moved and placed in another area if the person felt they had made a mistake.

The Web based version was completed twice after a 10 minute break, to assess intrarespondent variation reliability, and compared with the paper version to assess validity. In a randomized manner, half of the participants completed the Internet version first and half completed the paper version first. In addition, the patients were asked to assess the ease of use and suggest changes to the Internet version.

Creating VAS within a Web page. Hypertext mark-up language (HTML) code is used to define the appearance of Web pages and Web based forms. However, HTML allows only simple interactions such as clicking on check boxes. To create VAS it is necessary to use JavaScript. This language is embedded within HTML code and enables more interaction between the user and the Web page. One effect most commonly associated with JavaScript is the image rollover effect. This is used in the BASFI form to give the impression of a pen mark being placed on the 10 cm horizontal line. The line is 100 images placed side-by-side on the Web page. When one of these images is clicked it is substituted with the image of the pen mark (the X). The appearance of the Web version of the BASFI form is shown in Figure 1. The images of the line parts are stored in a separate file (a GIF or Graphical Interchange Format file). Each image is given a unique name that is used to determine which part of the line the user has clicked on. The position of the pen mark is stored in a hidden input (an input that cannot be seen by the user of the Web page). The hidden input contains the severity value expressed as a percentage, e.g., 53. The JavaScript is also used to perform other functions, such as checking whether the user has answered all the questions prior to submitting the form. Overall, this very simple approach has been used to construct a highly effective Web version of the BASFI form.

Statistical methods. Repeatability was assessed by calculating the interclass coefficient of the 2 Internet readings carried out one after the other. Validity was calculated by calculating the interclass coefficient of the paper version compared to the Internet version of the questionnaire. In addition, the Bland and Altman method of assessing agreement was used[6].

RESULTS

The sample of 50 patients who completed the questionnaire had an average disease duration and age of 19.7 years and 44 years, respectively, and an average functional score of 4.0 (minimum-maximum 0.71–9.6, scale 0–10; Table 1). The Internet version was rated as extremely easy to use, with 48 (96%) rating usability as 1 on a scale of 1–10 (1 being extremely easy and 10 being impossible). More than half (34) of the participants reported that they would prefer to complete the Internet version rather than the paper version. The repeatability and validity were found to be high, with interclass coefficients of intrarespondent and interrespondent reliability of 0.989 ($p < 0.001$) and 0.976

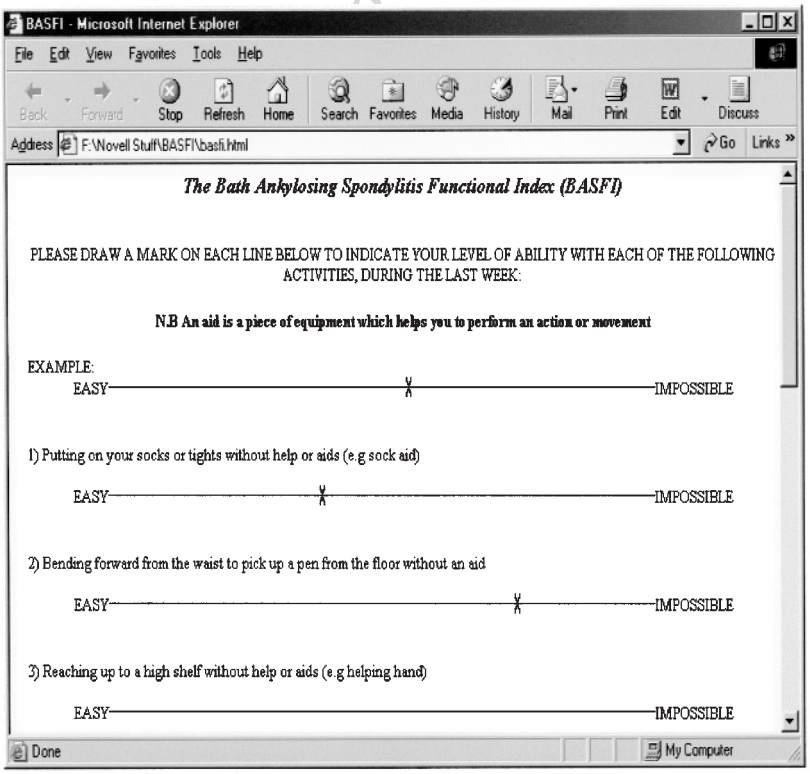

Figure 1. The Web based version of the BASFI form has been designed to look like the paper based version including the pen marks made on the horizontal scales.

Table 1. Demographic data. Results expressed as mean, standard deviation (range).

M:F	2.8:1
Disease duration	19.7, 10.1 (0–43)
Age	43.9, 10.0 (26–64)
Age onset	23.1, 6.9 (14–46)
Average function	4.0, 2.4 (0.71–9.6)

($p < 0.001$), respectively. There was a 3% difference in assessments carried out over the Internet compared to those carried out on paper and a 2% difference in repeatability of Internet assessed questionnaires. The Internet form was rapid to complete, taking less than a minute to complete all 10 questions. Bland and Altman plots used to assess agreement showed that the mean difference between paper compared to Internet versions was 0.0156 with 95% limits of agreement at –1.07 to 1.03. The mean difference between the first (time 1) and second (time 2) Internet versions was 0.02 with 95% limits of agreement at –0.69 to 0.74 (Figures 2 and 3). From the Bland-Altman plot it appears that people with poor function scored higher on the Internet questionnaire than on the paper questionnaire and people with good function scored higher on the paper questionnaire and lower on the Internet questionnaire ($p = 0.055$). However, the absolute difference between high and low functional scores was comparable ($p = 0.11$).

DISCUSSION

An Internet version of the VAS was easy to use, valid, reproducible, and reliable. This method of gathering data does require that the patient has basic computer knowledge and can see a computer screen. Therefore it is not suitable for people with no computer experience or very poor vision. However, it can be used with pointer devices and so could be useful for people with severe arthritis in their hands who cannot use a pen.

Our study involved people attending a physiotherapy/educational course whose average age was 45 years and whose functional score crossed the entire range of the scale. There were a number of patients who initially reported they did not feel confident using a computer and who reported that they did not have access to a computer at home. However, there were also younger people included in the sample who reported working on computers daily. Even though the computer background of the participants was mixed, the majority felt that the Internet version of the questionnaire was better than the paper version. However, patients may have been more conscientious about completing the questionnaire and the evaluation may have appeared more valid and reliable than if it had been tested at home. However, the test setting may have meant that people who would never normally complete forms over the Internet, and who do not have access to the Internet, were asked to participate. This group would not have been included in a home assessment and without them the sample population may not have been representative of the AS population. Therefore, our study sample is more likely to reflect the range of functional scores and computer abilities of patients with AS.

Patients with poorer function were found to score higher on the Internet version of BASFI than on the paper version (average difference of 0.24 between Internet score and paper score for people with an average functional score of 5–10) and the people with good function were found to score lower on the Internet version than the paper version (average difference of –0.13 between Internet score and paper score for people with average functional scores of 0–4.9). Those with poor function were significantly older than those with good function [39.7 yrs (function 0–4.9)

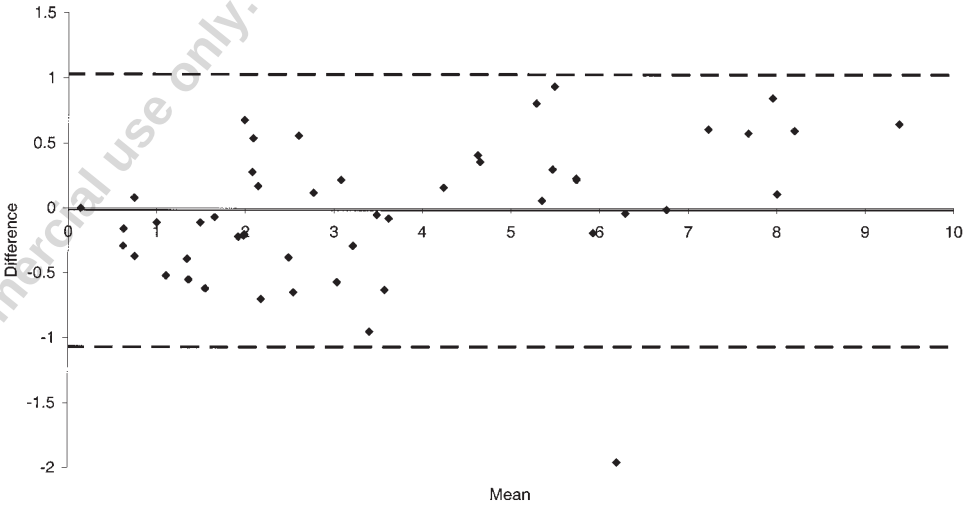

Figure 2. Bland-Altman plot of paper compared to Internet reliability. 95% limits of agreement –1.07 to 1.03; mean difference –0.0156.

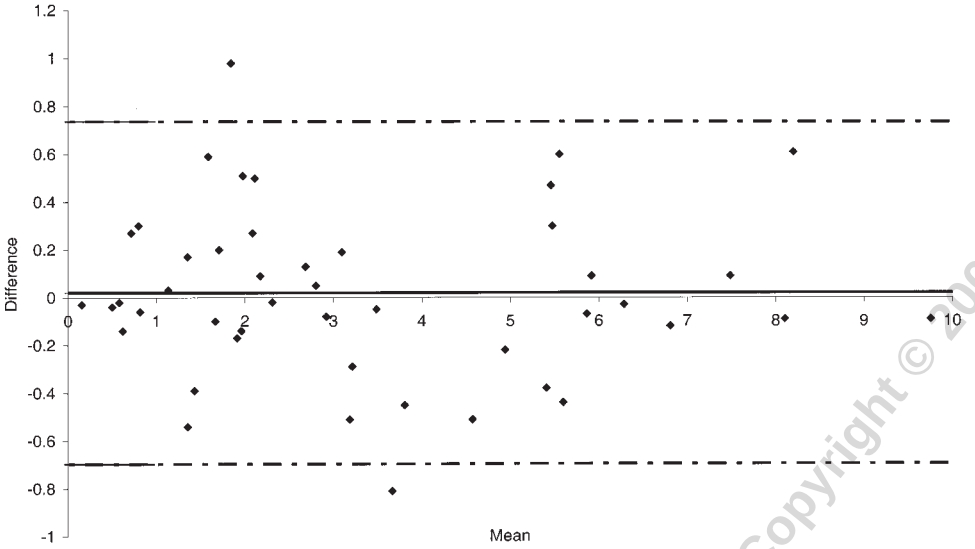

Figure 3. Bland-Altman plot of time 1 compared to time 2 Internet reliability. 95% limits of agreement –0.69 to 0.74; mean difference –0.02.

compared to 53.1 yrs (function 5.0–10); $p < 0.001$]. Therefore, it is possible that the older people with poor function found the Internet version more difficult than the paper version and subconsciously rated all the functional assessments in BASFI as a bit more difficult. The younger people with better function may have found the Internet version very easy to complete and subconsciously rated all functional activities described in BASFI is a little bit easier than when they were completing the paper version.

The use of this method for young people with arthritis (or other conditions that require self-assessment) would facilitate comparisons across countries without the expense and time of data entry or postage costs and with instant receipt and e-mail reminders. Longitudinal studies may be conducted easily, reliably, and at less cost, even if people move house or country, and followup studies can be continued.

In summary, the assessment of disease severity by VAS may be accurately carried out over the Internet. This means that the evaluation of disease status and followup of patients in different countries and perhaps in different languages may now be possible using the Internet.

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