Ambulatory Orthopaedic Surgery Patients’ Knowledge with Internet-based Education

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1. Introduction

The amount of medical information on the Internet is growing [1–3]. At the same time, there is growing interest in the effectiveness of patient education when using the Internet. Internet interventions is a concept that encompasses various types of web programs, including behaviourally-based and empirically validated web-based treatment programs, as well as patient education sites [4]. There is evidence of the effectiveness of the Internet-based education in terms of the patients’ health-related behaviour [5, 6]. In addition, there are reviews about the effects of Internet-based education on patients’ knowledge [6–13]. However, there is a scarcity of studies on surgery patients and, especially, ambulatory surgery patients; thus, the importance of determining the usefulness of Internet for these patients is evident [1, 14, 15].

In this study, we wanted to focus on Internet-based intervention studies dealing with ambulatory orthopaedic surgery. This limitation was made because patient education with ambulatory orthopaedic surgery patients is different than, for example, with long-term care patients. The content of the education and the knowledge differs with different patients. Ambulatory orthopaedic surgery patients are usually young and healthy. They need a lot of knowledge about their care and they need to be handled quite independently in their care. There are some studies about the use of the Internet in patient education with ambulatory orthopaedic surgery patients [16, 17]. Hering et al. [17] studied the impact of a website on patient knowledge using a randomized controlled trial (n = 164) with a controlled intervention of nurse-based education (standardized verbal instructions). They found that the use of a website was more effective in improving patients’ knowledge of anaesthesia. However, there has been no research done on how demographic variables affect patients’ knowledge.

2. Objectives

The aim of this study was to compare ambulatory orthopaedic surgery patients’ knowledge using Internet-based education (experiment) and face-to-face education with a nurse (control). The following hypothesis was proposed: Internet-based patient education (experiment) is as effective as face-to-face education with a nurse (control) in increasing patients’ level of knowledge and sufficiency of knowledge. In addition, the correlations of demographic variables were tested.

3. Methods

3.1 Study Design

The study design was a randomised controlled study. This clinical trial has not been registered, since, at the time when we started, a trial register for this kind of study did not yet exist in Finland. All ambulatory surgeries...
orthopaedic surgery patients (n = 173) in one university hospital in Finland (one of the five hospitals), between July 2005 and September 2006, were eligible for inclusion in the study. The final response rate was 86% (149/173). Patients fulfilling the inclusion criteria received a letter of invitation to participate in our study at the same time that they were scheduled for the ambulatory surgery operation. At the same time, they received the first instrument (baseline). The inclusion criteria were that a patient needed to be over 18 years of age, Finnish-speaking, have access to the Internet at home and the capability to use it, have no cognitive disabilities, and have the capability to complete the instruments and provide informed consent. The exclusion criteria were an ASA-classification of over II (A classification by the American Association of Anaesthetists = ASA) [18]. This study design produced also studies from the perspectives of Internet-based intervention and patients’ evaluation of that [19](Fig. 1).

### 3.2 Interventions

Patients in the experiment group participated in the Internet-based patient education designed for this study. The patients’ evaluation of this education has also been published in the earlier studies (see [19]). The educational programme was structured based on six areas of knowledge, bio-physiological, functional, experiential, ethical, social and financial [20, 21], which are defined as being important in the cognitive empowerment process [22]. The website consisted of knowledge about nine topics on surgery (for example, instructions for preparing for the operation, the schedule of events on the operation day, follow-up care, financial aspects, and frequently asked questions by patients). Patients visited the website 1–121 days (mean = 14, SD 19.1) before the operation. Patients waiting times for the knee arthroscopy is 152 days (mean) or for the arthroscopic operations on meniscus of knee is 140 days (mean) [23]. Patients were asked about their usage and the application time on the website. Patients used the website four to six times (mean 2.3). The application time for the website ranged from 10 to 300 minutes (mean = 81, SD 66.7).

Patients in the control group participated individually in face-to-face patient education with a nurse (in total, eight nurses) in a separate room in the ambulatory surgery unit. The theoretical base for the patient education with a nurse is the same as the Internet-based education. Patients were given a leaflet about the content of the session. Nurses were trained for this study and they knew the content of the website (Internet-based education) and they had the printed version of the website available. The face-to-face education session took place, on average, nine days before the operation (range 1–55 days, SD 7.1) and lasted, on average, 22 minutes (range 10–40 min, SD 7.0).

### 3.3 Randomisation and Stratification

The patients were randomly assigned (based on gender, age, and the location of the operation) to either the experiment group (n = 72) that received patient education via the Internet or to a control group receiving face-to-face education done by nurses (n = 75). Two patients in the control group were excluded from the study because they did not come to the patient education sessions. Neither the patients nor the study coordinator were aware of the educational assignment until after everyone had been randomly assigned to their groups.

### 3.4 Instruments and Data Collection

The data were collected using two structured instruments: the Knowledge Test (KT) and the Sufficiency of Knowledge (SoK) instrument. These two instruments were used before the preoperative education session (baseline), after the preoperative education (2nd measurement) and two weeks after the operation (3rd measurement). The idea behind these instruments was to measure patients' knowledge as a cognitive outcome. The knowledge was measured objectively with a knowledge test (KT) and subjectively by evaluating patients’ beliefs (SoK).

The KT instrument has 27 items and six subscales: the bio-physiological (eight items; for example, knowledge about symptoms, treatment, complications), functional (four items; for example, mobility, rest, nutrition, body hygiene), experiential (three items; for example, emotions, hospital experiences), ethical (five items; for example, rights, duties, participation in decision-making, confidentiality), social (three items; for example, families, other patients, patient unions) and financial (four items; for example, costs, financial benefits) dimensions of knowledge. The
KT instrument has a three-point scale: correct, incorrect and do not know. The patients were asked, for example, if it is correct or incorrect that they can eat before the operation, that they can drive home after the operation, or that they can see all of their care documents. The proportion of the patients’ correct answers in each dimension and in total was calculated. The respondent received a score in each dimension and in total, which was calculated by adding the correct answers (maximum 27) and calculating the mean. For example, the bio-physiological dimension consisted of eight items, so the correct answers were proportioned according to eight items. Thus, the maximum score was one (correct answer) and the minimum score was zero (incorrect or do not know answer) in all dimensions and in total.

The SoK instrument has 32 items (plus 13 sub-items, equalling 45 in total). It includes the same six subscales as the KT instrument: bio-physiological (seven items and 13 sub-items), functional (seven items), experiential (three items), ethical (nine items), social (two items) and financial (four items). The patients were asked, for example, if they had enough knowledge about pain, their symptoms and the costs of care. The SoK instrument has a four-point scale (1 = strongly disagree and 4 = strongly agree), with a higher score indicating higher levels of sufficiency of knowledge. The SoK instrument was constructed based on six dimensions of knowledge by calculating the means for the sum variables. The sum variable was calculated if the patient had answered at least 50% of the items; otherwise, the sum variable was considered to be a missing value. The total indexes of sufficiency of knowledge were calculated by using the means of the six sum variables.

The following demographic characteristics were asked from the patients at baseline: gender, age, basic and vocational education, and the number of prior ambulatory surgery operations.

### 3.5 Statistical Analysis

The data were analyzed statistically using SPSS for Windows (version 16.0). The results are shown as frequencies, percentages, means and standard deviations. The Pearson Chi-Square test was used for the comparison of the sample demographic characteristics between the groups.

The effect of socio-demographic variables (age, gender, basic education, professional education and earlier ambulatory surgery) from the pre- to postoperative phases on knowledge level and sufficiency of knowledge was tested using one-way analysis of variance and a two-sample T-test adjusted p-value using Tukey’s method.

### 3.6 Ethical Considerations

Ethical approval for the study was obtained from the ethical research committee of the hospital district. Patients were informed and they agreed to participate in the study on a voluntary basis via informed written consent.

### 4. Results

#### 4.1 Demographic Variables

A total of 147 (= n) ambulatory orthopaedic surgery patients were enrolled in the study: 72 patients in the experiment group and 75 in the control group. There were no statistically significant differences between the groups in terms of the demographic variables (p = 0.189 – 0.976). The average age of the participants in the Internet-based education group was 44.2 years (range 18 – 69, SD = 12.73) and 43.5 years (range 18 – 67, SD = 12.74) for participants in the face-to-face education group (Table 1).

### 4.2 Knowledge Level and Sufficiency of Knowledge

Patients in both groups showed improvement in their knowledge during their care (Table 2). Patients who received Internet-based education improved their knowledge level significantly more (p = 0.033) than those patients who underwent face-to-face education with a nurse. There were no differences in patients’ sufficiency of knowledge (p > 0.05) between the experiment and control group.

#### 4.3 Relationship between Knowledge Level and Sufficiency of Knowledge and Demographic Variables

In the experiment group, knowledge level was related to the patients’ level of profes-
sional education. After the education, patients who had no professional education evaluated their knowledge level as lower than those who had secondary (0.53–0.63) than those who had secondary (0.59) or upper secondary (0.66) or polytechnic or university (0.70) education. The patient’s age, gender, basic education and earlier ambulatory surgery were not related to her or his knowledge level. In the control group, age and earlier ambulatory surgery experience were related to patients’ knowledge level. Two weeks after operation, the youngest patients (18–34 years old) had a lower knowledge level than the older patients (0.53–0.63). For the control group, knowledge level was related to the patients’ experience with earlier ambulatory surgery. Patients who had had earlier ambulatory surgery had a higher knowledge level than those who had not had ambulatory surgery in all measurement times: before the education (0.55–0.39), after the education (0.62–0.51), and two weeks after the operation (0.66–0.36). The patient’s gender or basic and professional education was not related to their knowledge level in the control group.

In the experiment group, sufficiency of knowledge was related to the patients’ age, gender and earlier ambulatory surgery experience. Before the education, the youngest (18–34 years old) patients experienced their sufficiency of knowledge as lower than that of the older (35–50, 51–69) patients (mean ± SD, 2.43 ± SD vs. 2.90 ± SD). Women’s sufficiency of knowledge was higher than men’s after the education (3.39±SD VS 3.03 ± SD) and two weeks postoperatively (3.53 ± SD vs. 3.28 ± SD). In addition, before the education the patients who had had earlier ambulatory surgery experienced their sufficiency of knowledge as higher than did those who had not had ambulatory surgery (2.90 ± SD vs. 2.50 ± SD).

In the control group, patients’ sufficiency of knowledge was related to the patients’ earlier ambulatory surgery experience. Two weeks after the operation, patients who had had earlier ambulatory surgery experienced their sufficiency of knowledge as higher than did those who have not had ambulatory surgery (3.34 ± SD vs. 3.07 ± SD). The other demographic variables did not differ significantly.

### Table 2 Patients’ knowledge level and sufficiency of knowledge during three different phases of care (A = experiment group, B = control group)

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Before education mean A/B</th>
<th>After education mean A/B</th>
<th>Two weeks after operation mean A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge level</td>
<td>0.48/0.48</td>
<td>0.63/0.57</td>
<td>0.65/0.62</td>
</tr>
<tr>
<td>Sufficiency of knowledge</td>
<td>2.73/2.73</td>
<td>3.29/3.05</td>
<td>3.40/3.22</td>
</tr>
</tbody>
</table>

### Table 3 The associations between patients’ knowledge level and demographic variables (A = experiment group; B = control group)

<table>
<thead>
<tr>
<th>Object</th>
<th>Before education P-values A/B</th>
<th>After education P-values A/B</th>
<th>Two weeks after operation P-values A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age*</td>
<td>0.080/0.172</td>
<td>0.570/0.157</td>
<td>0.927/0.028</td>
</tr>
<tr>
<td>Gender**</td>
<td>0.643/0.374</td>
<td>0.654/0.079</td>
<td>0.079/0.500</td>
</tr>
<tr>
<td>Basic education*</td>
<td>0.902/0.668</td>
<td>0.155/0.786</td>
<td>0.574/0.764</td>
</tr>
<tr>
<td>Professional education*</td>
<td>0.472/0.612</td>
<td>0.007/0.865</td>
<td>0.130/0.641</td>
</tr>
<tr>
<td>Earlier ambulatory surgery**</td>
<td>0.116/0.001</td>
<td>0.953/0.002</td>
<td>0.919/0.006</td>
</tr>
</tbody>
</table>

* One-way analysis of variance adjusted p-value using Tukey’s method
** Two-sample T-test adjusted p-value using Tukey’s method

### Table 4 The associations between patients’ sufficiency of knowledge and demographic variables (A = experiment group; B = control group)

<table>
<thead>
<tr>
<th>Object</th>
<th>Before education P-values A/B</th>
<th>After education P-values A/B</th>
<th>Two weeks after operation P-values A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age*</td>
<td>0.045/0.399</td>
<td>0.293/0.369</td>
<td>0.118/0.711</td>
</tr>
<tr>
<td>Gender**</td>
<td>0.566/0.296</td>
<td>0.001/0.806</td>
<td>0.010/0.694</td>
</tr>
<tr>
<td>Basic education**</td>
<td>0.914/0.829</td>
<td>0.728/0.331</td>
<td>0.368/0.432</td>
</tr>
<tr>
<td>Professional education**</td>
<td>0.974/0.815</td>
<td>0.371/0.943</td>
<td>0.272/0.868</td>
</tr>
<tr>
<td>Earlier ambulatory surgery**</td>
<td>0.006/0.117</td>
<td>0.961/0.074</td>
<td>0.938/0.030</td>
</tr>
</tbody>
</table>

* Two-sample T-test adjusted p-value using Tukey’s method
** One-way analysis of variance adjusted p-value using Tukey’s method

5. Discussion

We hypothesized that Internet-based patient education (experiment) is as effective as face-to-face education with a nurse (control) in increasing patients’ level of knowledge and sufficiency of knowledge. In addition, the correlations of demographic variables, level of knowledge and sufficiency of knowledge were tested. The hypothesis was confirmed and patients’ knowledge improved with the Inter-
net–based education. When we measured patients’ knowledge objectively, patients having Internet-based education had higher knowledge levels than patients receiving face-to-face education with a nurse. However, when patients’ knowledge was measured subjectively, there were no differences between the two types of education in terms of patients’ experiences of sufficiency of knowledge. In addition, some correlations between patients’ knowledge and demographic variables were found.

There are only a few earlier studies on the cognitive outcomes of Internet–based education [6–13]. This is surprising because it is known that use of the Internet is growing and more and more people are also searching for knowledge from the Internet for their health problems. According to this (see also [17]), the Internet is thus a viable method in patient education. In this study, patients in the Internet-based education group managed well with their education. Based on the earlier study concerning this Internet-based education method, patients evaluated Internet as usable in their surgery process [19]. However, patients in the Internet group used much more time for their education than did patients receiving face-to-face education. These differences in time might also affect the patients’ knowledge level and sufficiency of knowledge.

Patients’ demographic variables were slightly related to patients’ level of knowledge. However, the related variables were different in the experiment group and the control group. It seems that in the experiment group patients who had no professional education had a lower knowledge level than those who had professional education. This difference was not significant in the control group. It might be that the more educated patients are also more used to using the Internet. In the control group, the youngest patients had a lower knowledge level than the older patients did (two weeks after operation).

The earlier ambulatory surgery experience was related to the patients’ knowledge level in the control group in all phases of care. There were no similar differences in the knowledge level of the experiment group. It seems that face-to-face education cannot improve patients’ knowledge level equally if the patient has had earlier ambulatory surgery. Could it be that the nurse assumes too much about the patients’ knowledge level and the content of the education is not sufficient? This problem is easily avoided with the Internet education, since the content of education is the same for all.

In the experiment group, patients’ sufficiency of knowledge was related to their age, gender and earlier ambulatory surgery experience. The Internet-based education especially improved the sufficiency of knowledge of the youngest patients and patients with no earlier ambulatory surgery experience. Those patients might also benefit the most from Internet-based education. In addition, sufficiency of knowledge was highest among women after the education in the experiment group. In the control group, only earlier ambulatory surgery experience was related to the patients’ higher sufficiency of knowledge two weeks after the surgery.

6. Conclusion

Internet-based education could be used with ambulatory orthopaedic surgery patients. The Internet is a successful method in patient education and it improved patients’ knowledge even more than face-to-face education.

The relation between the patients’ demographic variables and their level of knowledge varied. It seems that the Internet is a successful method especially with young people, women and patients with no earlier ambulatory surgery experience. Face-to-face education could not improve the knowledge level of the patients equally well if a particular patient had had previous ambulatory surgery. This issue calls for further research.

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References