Original article

Influence of mobile education on joint function and quality of life in patients after total hip arthroplasty

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Article info

Objective: To explore the influence of applying educational animated film as continuous post-discharge rehabilitation guidance for patients after total hip arthroplasty (THA).

Methods: Sixty patients discharged after THA were randomly divided into two groups. Traditional methods, such as distributing manuals of rehabilitation guidance on THA and phone call follow-ups, were adopted in the control group, whereas educational animated film was used as continuous rehabilitation guidance after discharge in the experimental group. Differences in recovery of hip joint function, accuracy of functional exercise, mastery of rehabilitation knowledge and quality of life between the two groups were compared.

Results: The experimental group had superior performance on all indicators compared to the control group (P < 0.05).

Conclusions: The use of educational animated film as continuous post-discharge rehabilitation guidance in patients after THA achieved better effects than traditional education methods.

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1. Introduction

Functional rehabilitation is one of the three intervention methods in orthopedic rehabilitation.1 Recovery from THA requires a long time, after which patients might suffer from difficulties in self-care. Science-based functional exercise and rehabilitation guidance are crucial for patients to restore hip function, regain self-care abilities and improve quality of life.2 Rehabilitation after THA, however, involves professional medical knowledge that can be difficult for patients to fully and correctly comprehend. Thus far, continuous rehabilitation guidance after THA has been implemented only by distributing health education manuals,3 making phone calls and nursing care follow-ups,4 among others, which was still not enough and lead to inadequate and improper rehabilitation exercise and decline in patients’ compliance directly affecting recovery of joint function. Shen et al6 provided rehabilitation guidance on THA using multimedia videos and had them played in wards, which has been shown to achieve positive effects. However, videodiscs are inconvenient for use after discharge. Instead, researchers made an educational animated film that was visual, easy to popularize and accessible anytime and anywhere. The results of using these videos are reported below.

2. Research materials and methods

2.1. Research materials

A total of 60 patients, admitted to our department from June 2014 to June 2015, with necrosis of the femoral head after THA were...
selected and assigned to the control group and the experimental group using a random number table with 30 cases in each. All surgeries in both groups were performed by 2 chief physicians under intra-spinal anesthesia. Differences in sex, age, disease progression and level of education between the 2 groups were not statistically significant \((P > 0.05)\), and the baseline information was similar as shown in Table 1.

The inclusion criteria were (1) patients with late necrosis of the femoral head treated with THA, (2) patients in stable condition after primary surgery with no possible influence on physical sense and movement, and (3) patients who voluntarily joined this study with informed consent and accepted follow-up visits. The exclusion criteria were (1) patients with a history of mental or neurological diseases, drug addiction or severe cognitive impairment, (2) patients with severe complications, and (3) patients with complications producing severe impairment of important viscera.

### 2.2. Multimedia production

The research team consisted of 2 chief physicians, 2 associate chief physicians, 3 chief nurses, 2 associate chief nurses, and 2 supervisor nurses, all of whom had at least a bachelor’s degree. The program started with a script written by the research team, in which rehabilitation guidance, functional exercise techniques and matters needing attention in daily life were incorporated. Then, the script was finalized to one relatively comprehensive and complete piece after numerous discussions and approval by dozens of experts. At last, it was produced into an educational animated film, taking daily life post-discharge after THA as the main storyline. A middle-aged, approximately 50, cartoon character was developed through whose life the film aimed to show patients functional exercise techniques, using crutches/walker and walking up and down stairs, correct postures, movements to avoid, training methods for changing posture from lying to standing, sitting then walking, proper movements of sitting, standing, walking, lying, getting in and out of bed, crossing over obstacles, squatting, taking bus, putting on and taking off clothes, going to toilet, bathing and matters needing attention in daily life. Going to every possible aspect of daily life was involved to direct patients into correct functional exercises and everyday activities after discharge. To be applicable to various multimedia devices, such as portable VCD player, tablets, and momo3 or mobile phones, mp4 players, and mp5 players, the film was put on DVD discs and transferred to corresponding video forms including avi, mov, mpge, flv, rm, rmvb, dat, wmv, mtv, mp4 and awf.

### 2.3. Intervention methods

The same THA treatment, nursing care and health education program were given to the 2 groups during hospitalization. The health education program included distribution of health education materials (rehabilitation manual on THA) to patients immediately after admission, organization of intensive education twice (before surgery and before discharge), arrangement of routine education 3 times by nurses in charge, and provision of education at any time during daily treatment and nursing care. Phone call follow-ups were made 4 weeks after discharge, and an evaluation was performed 12 weeks after discharge at the return visit, in which every relevant indicator was assessed. Functional exercises were monitored with a functional exercise diary distributed to each group, which was composed of the date and the to-do list of exercises that were documented by a check mark. Nurses in charge were responsible for completing the form every day after supervising patients in their exercises.

The control group was instructed to take the health education manual home for continuous study, and patients in the experimental group took home the educational animated film. Nurses in charge were responsible for putting the film in their mobile terminals, teaching them how to use it to help with exercise and determining how well they understood the film to ensure that they were able to use it skillfully.

### 2.4. Evaluating indicator

Hip joint function; compliance with functional exercises; mastery of rehabilitation exercise skills; NHP health status.

### 2.5. Evaluation methods

#### 2.5.1. Evaluation of effectiveness of postoperative functional exercise

Evaluations were performed by 2 associate chief physicians on the research team 12 weeks after discharge at the return visit in accordance with Harris scoring criteria,\(^6\) in which joint function, pain, range of joint motion and joint deformity are scored. The total score was 100 points, joint function (including gait and functional activities) accounted for 47 points, pain for 44 points, range of joint motion for 5 points, including addition, bending, outreach and internal and external rotation, and joint deformity counted for 4 points. The higher one scored, the better the hip joint functioned.

#### 2.5.2. Evaluation of compliance with functional exercises

There is still no uniform standard at home or abroad for evaluation of compliance with functional exercises. Therefore, after evaluating the literature from Cheng et al,\(^7\) this paper used 3 aspects, including number of exercises, exercise initiative and task completion, to assess compliance, and scored participants from low to high as 1, 2, 3, 4. The counts of completion, voluntary exercise and exercise up to a stipulated time were recorded, and those with 75–100%, 50–69%, 25–49% and below 24% in each category were, respectively, scored as 4, 3, 2, and 1, for a total score of 12 points. The higher one scored, the better the compliance with functional exercises. The daily functional exercise forms were collected and analyzed at the return visit.

#### 2.5.3. Evaluation of mastery of rehabilitation exercise skills

As demonstrated in the questionnaire, rehabilitation exercise skills were divided into 5 categories (movements of sitting, standing, lying and walking, use of walker, rehabilitation exercises, support).
daily activities and self-care abilities), and 19 items in total were evaluated for a total score of 100 points. The evaluation was performed by an associate chief physician on the research team 12 weeks after discharge at the return visit, and grades of 90–100 points were excellent, 80–89 were good, 70–79 were average, and below 70 was poor. NHP8 evaluation of health condition. The evaluation included 6 health indicators of pain, energy, sleeping condition, activity, emotional response, and social segregation and was completed by two researchers 12 weeks after discharge at the return visit, in which unified instruction was used to make sure all patients could fully understand. The lower one scored, the better the health status.

2.6. Statistical methods

SPSS 11.5 statistical software was used to perform Chi-square tests to analyze categorical data, mean ± SD to describe measurement data, t-tests to analyze measurement data. Significant differences were indicated when $P < 0.05$.

3. Results

3.1. Comparison of effect on functional exercise 12 weeks after surgery (Table 2)

3.2. Comparison of compliance with functional exercise 12 weeks after discharge

Patients' compliance was accessed by researchers at the follow-up visit 12 weeks after discharge. The results showed that compliance with functional exercises were higher in the experimental group than in the control group ($P < 0.05$), as shown in Table 3.

3.3. Comparison of mastery of rehabilitation exercise skills 12 weeks after discharge

Results showed that mastery of rehabilitation exercise skills in the experimental group was significantly superior to that of the control group ($P < 0.05$), as shown in Table 4.

3.4. Evaluation of health status by NHP scale

Results showed that NHP scores in the experimental group 12 weeks after discharge were significantly better than that of the control group ($P < 0.05$), as shown in Table 5.

4. Discussion

4.1. Contribution of mobile education to recovery of joint function after THA

As shown in Table 2, Harris scores of hip function in the experimental group were obviously higher than those in the control group ($P < 0.001$). Regular exercise for joint function and proper activities in daily life could increase muscle strength, improve hip joint function and reduce risk of complications.9 Rehabilitation exercise after THA required very professional medical skills. If used incorrectly, excessively or insufficiently, patients were prone to suffer from loosening and wear of prosthesis, dislocation of hip joint, fracture, or displacement of rotation center, for which reasons the whole process should be under professional instruction. However, in China to date, professional rehabilitation guidance after THA is performed only during hospitalization, and rehabilitation after discharge is under no professional management. What’s more, recovery from THA is a long-time process, generally 4–6 months, during which patients have to do most of the rehabilitation exercises themselves at home and yet often do not continue or complete exercises correctly. Thankfully, this animated film, covering every possible aspect of postoperative life, could provide patients the same professional medical guidance after discharge as medical staff did, in which training methods were vividly introduced step-by-step, accelerating recovery of hip joint function.

4.2. Improvement in compliance with functional exercise by educational animated film

Symptoms such as pain, reduction in range of joint motion and joint dysfunction might appear after THA. In telephone follow-ups, patients tended to complain of pain, troubles in wearing trousers and socks, difficulties in climbing stairs, limping and inability to care for themselves, all of which could cause decline in patients' compliance. Yu et al10 reported that after THA, the incidence of late complications was as high as 25% in patients with poor compliance. In these circumstances, educational animated films, as a form of art, were fun and relaxing for patients and thus took initiative to imitate. Additionally, it added fun to rehabilitation exercises and also alleviated pain. Making such tedious and professional knowledge simple and interesting could make it better understood and accepted. What’s more, it was motivating and turned passive education into active learning by providing learning opportunities anytime and anywhere. Families could take part in the process as well, enhancing the intervention effect of family nursing and improving patient compliance. The results shown in Table 3 indicate that patient compliance in the experimental group was significantly higher than that of the control group ($P < 0.05$).

4.3. Improvement in functional exercise skills through continuous education with an educational animated film

As shown in Table 4, 12 weeks after discharge, patients' mastery of functional exercise skills in the experimental group was

<table>
<thead>
<tr>
<th>Group</th>
<th>Number</th>
<th>1 point</th>
<th>2 points</th>
<th>3 points</th>
<th>4 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>30</td>
<td>4 (13.33)</td>
<td>4 (13.33)</td>
<td>6 (20.00)</td>
<td>11 (36.67)</td>
</tr>
<tr>
<td>Experiment group</td>
<td>30</td>
<td>7 (23.33)</td>
<td>4 (13.33)</td>
<td>5 (16.67)</td>
<td>20 (66.67)</td>
</tr>
</tbody>
</table>

Note: Comparison of the two groups ($\chi^2 = 8.19, P < 0.05$).

Table 2

Comparison of hip joint function after surgery by Harris score.

<table>
<thead>
<tr>
<th>Group</th>
<th>Joint function</th>
<th>Pain</th>
<th>Motion range of joint</th>
<th>Deformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>39.46 ± 3.05</td>
<td>36.31 ± 3.02</td>
<td>3.51 ± 1.07</td>
<td>2.62 ± 1.35</td>
</tr>
<tr>
<td>Experiment group</td>
<td>42.03 ± 1.52</td>
<td>40.34 ± 4.16</td>
<td>4.24 ± 0.32</td>
<td>3.68 ± 1.25</td>
</tr>
<tr>
<td>$t$</td>
<td>-4.1107</td>
<td>-4.2039</td>
<td>-3.5801</td>
<td>-3.1556</td>
</tr>
<tr>
<td>$P$</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.00007</td>
<td>0.0025</td>
</tr>
</tbody>
</table>

(P < 0.001). Regular exercise for joint function and proper activities in daily life could increase muscle strength, improve hip joint function and reduce risk of complications.9 Rehabilitation exercise after THA required very professional medical skills. If used incorrectly, excessively or insufficiently, patients were prone to suffer from loosening and wear of prosthesis, dislocation of hip joint, fracture, or displacement of rotation center, for which reasons the whole process should be under professional instruction. However, in China to date, professional rehabilitation guidance after THA is performed only during hospitalization, and rehabilitation after discharge is under no professional management. What’s more, recovery from THA is a long-time process, generally 4–6 months, during which patients have to do most of the rehabilitation exercises themselves at home and yet often do not continue or complete exercises correctly. Thankfully, this animated film, covering every possible aspect of postoperative life, could provide patients the same professional medical guidance after discharge as medical staff did, in which training methods were vividly introduced step-by-step, accelerating recovery of hip joint function.
significantly better than that of the control group ($P < 0.05$). Patients needed a long rehabilitation period after THA. On one hand, due to shortage of medical resources or for patients needed a long rehabilitation period after THA. On one hand, due to shortage of medical resources or for financial and family reasons, they could not remain in the hospital until completely recovered. Outside the hospital, on the other hand, it was also impossible for them to have medical staff accompanying them all the time. In such cases, mobile education could provide patients at home with professional and standard rehabilitation guidance. With repeated learning, patients were able to grasp the correct functional exercise methods and were aware of matters needing attention in daily life.

### 4.4. Improvement in all health indicators and quality of life by mobile education after THA

Mobile education conformed to the self-care concept of Orem’s theory. The film compensates for the nurse and not only improved patients’ self-nursing abilities and nursing skills but also enhanced their sense of self-responsibility and self-concept and increased the level of rehabilitation knowledge, thus speeding up recovery. Moreover, it helped to maintain harmonious family relations and improve quality of life by having families participate. As shown in Table 5, indicators such as pain, energy, sleep, activity, emotional response, social segregation and others in the experimental group were better than that of the control group ($P < 0.05$), and the difference was significant.

### 5. Conclusions

The best recovery of function in the affected limb is the key to operative success in THA. However, recovery is only guaranteed by effective health education throughout the whole process. Any improvement in guidance for functional exercise methods is bound to affect nursing quality and efficiency. As for patients, the use of an educational animated film that provided professional and standard guidance at home was similar to having medical staff around. With rapid development of digital media devices and support for advanced communication technology, mobile education aimed at offering support to any learners at anytime and anywhere has become a new research field in education technology in recent years. By applying mobile education as a nursing intervention outside the hospital, problems such as incorrect mastery of rehabilitation knowledge and skills as well as the incidence of complications due to insufficient nurse-care support could be effectively solved, thus promoting rehabilitation of limb function and improving quality of life.

### Conflicts of interest

All contributing authors declare no conflicts of interest.

### References
