Comparison of the effect of Cyriax cross friction massage and a Nintendo Wii-exercise program for the treatment of pain in chronic lateral epicondylitis

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Abstract

Objective: The aim of this pilot study is to compare the effectiveness of a supervised exercise program using the Nintendo Wii tennis game, to Cyriax cross friction massage in the treatment of lateral epicondylitis. Methods: 10 subjects participated in the study (5 males, 5 females; mean age 50.4 (SD 3.5). Six subjects followed the Wii exercise program and four subjects received cross-friction massage according to the Cyriax method. Subjects in the Wii exercise group (Wii) received 25 min. and the Cross friction massage group (CF) received eight min. of treatment. Both groups were treated twice a week during six weeks. Using the Visual Analogue Scale (VAS), pain levels were assessed at baseline and after completion of the program at six weeks. Outcomes were analyzed using the independent, dependent and paired sample t-test. Results: The difference in pre and post VAS scores was only significant within the Wii exercise group (p=.02), there was no significant difference found in pre and post VAS scores between the two intervention groups. Conclusion: The Nintendo Wii exercise program had a significant effect on pain reduction in treatment of lateral epicondylitis.

Keywords: Wii, Tennis elbow, Cross friction massage, Cyriax, CF, lateral epicondylitis.

Introduction

Professionals, athletes and other people who use quick, repetitive wrist supination and pronation movements during work, sports or play can suffer from lateral epicondylitis which is commonly referred to as “Tennis elbow” and one of the most occurring lesions of the arm. It can be defined as a syndrome of pain in the area of the lateral epicondyyle. Pain on palpation of the area, during resisted extension of the wrist - particularly contraction of the extensor radialis brevis - and during gripping are indicators for Tennis elbow. It is regarded as difficult to treat as symptoms might reoccur until up to four years (Murtagh 1988). A wide variety of treatment methods are mentioned for this pathology, which indicates the lack of full understanding of the mechanisms underlying Tennis elbow (Vicenzino 2003). Cross friction massage is a method recommended by Dr. Cyriax, a British orthopedic physician and
one of the foremost specialists in the diagnosis and treatment of musculoskeletal injury and pain syndromes. His method is used for the purpose of inflammation and pain reduction. Cross friction massage promotes circulation and breaks down scar tissue by manual manipulation of the tissue where remodeling has failed, either due to poor circulation, immobilization or repeated trauma. This can be painful during treatment since the affected structures need to be directly palpated. After a few min., local anesthesia is produced though (De Bruijn, 1984).

Exercise has been proven to be among the most efficient interventions used to treat Tennis elbow as long as it is not pain provocative (Vicenzino 2003). Since pain compromises functional motor activities and its reduction increases the subject's ability to exercise, it is very important to treat.

Cyriax Cross friction massage has had beneficial effects on pain and grip strength after 4, 8, 16 and 28 weeks of treatment (Stasinopoulos, 2006). Nevertheless, improvement was less than in an exercise program using slow eccentric movements of the wrist extensors. Pain free gripping tasks and exercises involving the extensor muscles of the wrist should be involved in exercises to treat Tennis elbow (Vincenzino 2003). Other muscle groups of the forearm should also be trained, since this enhances a functional activity pattern and helps in coping with daily life activities. Therefore, this study includes a new method that consists of a more functional way of exercising - the Nintendo Wii.

The Wii is a video game in which the subject can play tennis holding a wireless controller, moving as if he/she were a character in a game, which is shown on screen. The video game character then duplicates the action performed, simultaneously on screen.

The Wii benefits balance, arm-movement, eye-hand coordination and is being used for those purposes in elderly people, stroke and neurological patients (Nursing home care management Magazine, 2007). It has also shown to be beneficial for improving execution of small, fine tuned, controlled movements in surgeons in the United States (The New Scientist journal 2008). The exercises commonly performed for treating Tennis elbow are automatically involved in Wii exercise, but in a more functional way since isolated movements are not used. Flexion, extension, supination and pronation of the wrist are involved while playing Tennis with the Wii, following the instructions the researchers gave. Also, since there is no ball impact and no racket that acquires a lot of grip strength; the Wii should be less pain provocative than normal tennis playing in patients with a Tennis elbow.

To see whether Wii is effective at all, a commonly accepted and used method like Cross friction massage is a valid comparison. Cross friction was chosen because it is generally assumed to be effective and researchers wanted to compare a hands on with a hands off treatment. This can only be related to pain since Cross friction massage has no effect on muscle strengthening, although it can improve functionality by diminishing pain.

This research therefore aims at measuring the improvement in pain levels in Wii and CF groups, using the Visual Analogue Scale.

Methods

Subjects

14 Chronic unilateral Tennis elbow patients were recruited via written advertisement in Amsterdam and via the Physiotherapy Buur private clinic. All patients were screened with the inclusion criteria: aged 18 to 60 years, clinically diagnosed positive in thomsen or middle finger extension test and suffering from chronic Tennis elbow symptoms for at least 3 months. Subjects were excluded if the Foramina compression test elicited an increase or radiation of pain into the area of the lateral epicondyle, since there is evidence that supports involvement of cervical spine as a source of chronic Tennis elbow (Stratford et al. 1993; Vicenzino et al. 1996, 1998; Pienimaki et al. 1997b). In addition patients treated with Corticosteroid injections were excluded. Out of the initially 14 subjects, two were excluded due to negative signs on Thomsen and mid finger extension tests. Twelve subjects were sequentially allocated to two intervention groups:
Six to the Nintendo Wii Exercise (Wii) and six to Cross Friction massage (CF). Two subjects resigned from CF due to schedule incompatibility, leaving the CF group with only four subjects. Baseline characteristics are outlined in table 1.

**Table 1: Baseline characteristics**

<table>
<thead>
<tr>
<th>Group</th>
<th>Wii (n=6)</th>
<th>CF (n=4)</th>
<th>Total (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (M:F)</td>
<td>4:2</td>
<td>3:1</td>
<td>5:5</td>
</tr>
<tr>
<td>Age: mean (SD)</td>
<td>51.3 (3.6)</td>
<td>49.0 (3.1)</td>
<td>50.4 (3.5)</td>
</tr>
</tbody>
</table>

**Procedure**

This pilot study was conducted during six weeks, at the “Buur Physiotherapy” private clinic and the Apollo (Health and Fitness) Hall, both in Amsterdam; the Netherlands. The interventions were applied twice a week for 25 min. in the Wii and 8 min. in CF (Cyriax, 1992).

**Intervention**

**Nintendo Wii tennis game**

The Wii is a computerized (tennis) game shown on a screen. The subject holds a remote control, which is able to detect acceleration, orientation and movements in three dimensional motions as seen in picture 1. The remote is used as if it was a tennis racket and the player Controls the game by physical gestures. Those movements are shown at the same time in one of the (chosen) players on the TV screen as seen in picture 2.

The game protocol was performed by one of the two researchers and resembled a functional exercise program (Pienimaki et al, 1996). Each subject had a 10 min game demonstration with safety instructions prior to the first treatment session. The protocol was pre-tested with four volunteers and is outlined in Table 2. Each subject started the first game at a beginner’s level, with a score of zero. During consecutive sessions, the level of each subject was determined by his/her performance during each game. All scores were stored in the Wii. If a subject won a game, he/she would score points and therefore proceed at a higher level during the next session. Meaning the subjects’ computerized opponents would be playing faster, requiring him/her to react accordingly. Only one patient was treated in each session supervised by one of the researchers and time was controlled by a stop watch.

**Cross Friction Massage**

Deep transverse friction, based on the Cyriax method is a specific type of connective tissue massage applied precisely to the soft-tissue structures such as tendons (Stasinopoulos Johnson, 2004). It is claimed that CF is effective in both symptomatic pain relief and tissue healing. The application and protocol is outlined in table 2.
Outcome measurement

Subjects’ pain levels were measured on the Visual Analogue Scale (VAS) where 0 represents no pain and 10 very severe pain. This pain measurement has shown to be sensitive and valid (Stratford et al, 1987).

Statistical analysis

All statistical analyses were done by SPSS version 13.

Between-group differences at baseline such as age and gender were measured using the comparison of means, independent sample t-test.

The Independent sample t-test was also used to determine first the difference in pre VAS scores between the two groups, and then the difference in post VAS scores between Wii and CF. The paired sample t-test was employed to show differences in pre and post VAS within each group.

Results

No significant differences were found in age or gender between groups at baseline.

When comparing the first measurements on the VAS pain scale between the two intervention groups these showed similar pain levels. At the end of the study, pain levels between the two groups also revealed no significant difference in the independent sample t-test.

When comparing results within each group with the paired sample t-test as outlined in table 4 there is a significant decrease in pain (VAS scale) in the Wii (p=.02), but not in the CF group. Since a decrease in pain as high as 50% was found in the Wii as outlined in Bar graph 1, this can be regarded as clinically relevant.

Table 2: intervention protocol

<table>
<thead>
<tr>
<th>Environment</th>
<th>Wii</th>
<th>CF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apollo Health &amp; Fitness Amsterdam</td>
<td>“Buur Physiotherapy” Private Clinic</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Wii</th>
<th>CF</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 times a week</td>
<td>2 times a week</td>
<td></td>
</tr>
<tr>
<td>25 min of game</td>
<td>8 min of cross friction massage</td>
<td></td>
</tr>
<tr>
<td>1 break in between of no longer than 1 min</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Wii</th>
<th>CF</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pain free, not aggressive movements,</td>
<td>• Locate the Anterolateral aspect of lateral epicondyle, where extensor carpi radialis brevis inserts</td>
<td></td>
</tr>
<tr>
<td>• Extension and flexion of the wrist allowed</td>
<td>• Deep transverse friction massage, applying pressure to the tenoosseous junction in a posterior direction</td>
<td></td>
</tr>
<tr>
<td>• Subjects shouldn’t hold the controller with a fierce grip</td>
<td>• Elbow fully supinated and in 90˚ of flexion</td>
<td></td>
</tr>
<tr>
<td>• Safety strap worn around the wrist during the whole game</td>
<td>• Pressure is applied with the tip of the thumb in direction of fingers, which are placed on the posterior side for counter pressure</td>
<td></td>
</tr>
<tr>
<td>• Knees slightly bent, back straight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Subjects play three sets of tennis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Subjects control both of the players on one side of the tennis court (front net and back player)</td>
<td></td>
<td></td>
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</table>

Table 4: Vas mean scores and results of Paired sample t-test

<table>
<thead>
<tr>
<th>Group</th>
<th>Starting Vas score Mean (SD)</th>
<th>Ending Vas score Mean (SD)</th>
<th>Paired-sample t-test (2-tailed) p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wii</td>
<td>6 (.63)</td>
<td>3 (.21)</td>
<td>.02</td>
</tr>
<tr>
<td>CF</td>
<td>5.2 (.95)</td>
<td>3.5 (1.7)</td>
<td>.13</td>
</tr>
</tbody>
</table>
Bar graph 1: Mean pre and post VAS scores

Discussion

This study was conducted to assess the difference in effect of Wii and CF on Pain levels in patients with chronic Tennis elbow.

Analysis of outcome measures showed that only Wii intervention affected the reduction of pain significantly (p=.02). Although a reduction of the mean VAS scores in the CF group were observed, this didn't reach significance.

This study’s outcome supports Stasinopoulou's (2006) findings, which reported that CF had beneficial effects on pain, but that exercise therapy was more efficient. Though the exercise program used in this pilot study was a different one.

It could therefore be that exercise therapy is generally more efficient than CF in the treatment of Tennis elbow. Further studies would need to be conducted regarding this hypothesis but the results of this study show that the Wii is more effective than CF.

To assess the efficiency of Wii tennis in treating Tennis elbow, we chose a commonly used and accepted treatment (CF) to compare it with. Another exercise program could have been chosen instead, to make the two interventions more comparable. Since exercise is generally known to be efficient, the Wii should be compared to exercise programs to see whether it can be advised above other exercises. Also, the Wii could be compared to exercise interventions that have shown a clinically relevant effectiveness in former studies.

Seeing the fact that some patients in the Wii group were tennis players, they were very motivated and competitive in playing Wii. Symptoms were also being less provoked than during a normal tennis game, with neither racket nor ball impact.

Motivation might have played an important role in the treatment effectiveness of the Wii. Subjects in the Wii group were generally very enthusiastic about the activity which could have influenced their expectations, and outcome, positively. This can be regarded as a positive factor in clinical settings when employing the Wii during treatment.

A possibly confounding factor was that the two interventions were not really comparable. The Wii was not compared to other, commonly used exercise interventions, which could have said something about whether the Wii is valid as an “exercise” among exercises currently used for treating Tennis elbow.

Different rooms were used for each intervention, which might have had an effect on mood or motivation, since the exercise room was a big, light space and the CF a normal physiotherapeutic treatment room.

For an optimal exercise time, 25 min. were chosen for the Wii while CF was applied for only 8 min. It could be that the Wii would have been less effective if played during 8 min only.

When doing isolated movements, such as wrist extension and flexion in treating Tennis elbow, the exercise is standardized and repeatable in the same way. Since the Wii implicates more complex movements, it is difficult to standardize a way of playing. Subjects could have performed different motions using different amounts of force. This might have affected the outcome measures between subjects. Further research needs to be done, on how to optimally instruct Wii playing, making the exercise as standardized as possible among patients for future use.

Nevertheless, this study suggests that the Wii is efficient in treating Tennis elbow.
The sample size in this trial was very small, and the CF group consisted of fewer subjects than the Wii group, which might have made it more difficult to attain a significant difference in pain measurements in CF. A bigger sample size would also increase the external validity for the Wii outcome and could increase the amount of pain improvement measured, to clinically more relevant scores.

Muscle activity could be measured during Wii playing in order to compare it to different exercises that are being used for treatment of Tennis elbow.

Because the study was limited to a few months, it can't say anything about the long term effects of Wii exercise or CF in Tennis elbow as subjects could not be re evaluated after the study.

Wii exercise was compared to CF as to compare a Hands off and hands on treatment, it could be interesting to test the two together to see whether the effect would increase.

Further studies including more subjects, time and other, more comparable interventions plus a control group, should be conducted to test the effectiveness of the Wii.

**Conclusion**

Only the Wii exercise program had a significant effect on the reduction of pain levels in chronic tennis elbow patients in a program of 6 weeks. CF had no significant effect.

**Acknowledgements**

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**References**