

A TELEPHONE-BASED PHYSIOTHERAPY INTERVENTION FOR PATIENTS WITH OSTEOARTHRITIS OF THE KNEE

ADESOLA C. ODOLE, PHD^{1,2}, OLUWATOBI D. OJO¹

¹ DEPARTMENT OF PHYSIOTHERAPY, COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN, IBADAN, NIGERIA

² SCHOOL OF RESEARCH AND POSTGRADUATE STUDIES, FACULTY OF AGRICULTURE, SCIENCE, AND TECHNOLOGY, NORTH WEST UNIVERSITY, MAFIKENG CAMPUS, SOUTH AFRICA

ABSTRACT

This study assessed the effects of a 6-week telephone based intervention on the pain intensity and physical function of patients with knee osteoarthritis (OA), and compared the results to physiotherapy conducted in the clinic. Fifty randomly selected patients with knee OA were assigned to one of two treatment groups: a clinic group (CG) and a tele-physiotherapy group (TG). The CG received thrice-weekly physiotherapist administered osteoarthritis-specific exercises in the clinic for six weeks. The TG received structured telephone calls thrice-weekly at home, to monitor self-administered osteoarthritis-specific exercises. Participants' pain intensity and physical function were assessed at baseline, two, four, and six weeks, in the clinic environment. Within group comparison showed significant improvements across baseline, and at weeks two, four, and six for both TG and CG's pain intensity and physical function. Between-group comparison of CG and TG's pain intensity and physical function at baseline and weeks two, four, and six showed no significant differences. This study demonstrated that a six-week course of structured telephone calls thrice-weekly to patients at their home, to monitor self-administered osteoarthritis-specific exercises for patients with knee OA (i.e., tele-physiotherapy) achieved comparable results to physiotherapy conducted in the clinic.

Key words: Tele-physiotherapy, telehealth, telerehabilitation, osteoarthritis, pain, physical function.

This study investigated the success of telephone-based therapeutic intervention (i.e., verbal coaching) conducted by physiotherapists in Nigeria on the pain and physical function of patients with osteoarthritis (OA) of the knee.

employed therein are consistent with the practice of telehealth and physiotherapy in specific regions in Nigeria, and may be useful to other countries with similar needs.

TERMINOLOGY

Can telephone use alone, be considered telehealth or telemedicine? For the purposes of this study, this can be answered in the affirmative. The American Telemedicine Association (2013) defines telemedicine as “the remote delivery of healthcare services and clinical information using telecommunications technology. This includes a wide array of clinical services using internet, wireless, satellite and telephone media” (para. 1).

The telephonic methods employed herein are particularly relevant to the practice of physiotherapy in parts of the world wherein videoconferencing and other interactive telecommunications based technologies are unavailable or too expensive for widespread use. While recognizing that telephone communication alone may not qualify for reimbursement in some countries, and the methods described therein may be considered by some as “coaching” not therapy, the terminology and methods

OSTEOARTHRITIS (OA) OF THE KNEE

Osteoarthritis (OA) is a disease characterized by degeneration of cartilage and its underlying bone within a joint as well as bony overgrowth. OA is one of the most chronic and degenerative joint diseases and a major cause of pain and joint stiffness in the elderly (Doherty, 2002). It is also one of the most common musculoskeletal conditions resulting in disability (Mody & Woolf, 2003). The specific causes of OA are unknown, but are believed to be a result of both mechanical and molecular events in the affected joint. The disease onset is gradual and usually begins after the age of 40 years (Centers for Disease Control and Prevention, 2009). Knee OA results in persistent pain and limited function (Guccione et al., 1994) and substantially reduces life expectancy by 12% when occurring as a comorbidity with obesity (Warner, 2011).

Approximately 10% of men and 18% of women suffer symptomatic OA (Woolf & Pfleger, 2003) with radiological evidence in more than 50% of people over 65 years of

age (Royal Australian College of General Practitioners, 2009). Akinpelu, Odole, Adegoke, and Adeniyi (2007) documented that osteoarthritis is more common in females than males (3.5:1) and that the knee joint is most frequently affected.

Although OA occurs all over the world, there are ethnic differences in its prevalence (Mody & Woolf, 2003). At least two hospital-based studies have shown that OA is common in Nigeria (Akinpelu et al., 2007; Ogunlade, Alonge, Omololu & Adekolujo, 2005). OA is a common condition seen in the physiotherapy facilities in Lagos and Ibadan, accounting for about 9% of new patients.

The management of knee OA is focused on optimizing the patient's quality of life by decreasing pain and improving function (Hunter & Felson, 2006). Physiotherapy treatment for knee OA typically involves therapeutic exercises, a practice supported by high quality evidence (Jamtvedt, Dahm, Holm & Flottorp, 2008b). An overview of systematic reviews of physiotherapy interventions for patients with osteoarthritis of the knee demonstrates that exercise can reduce pain and improve function in patients with knee OA (Jamtvedt et al., 2008a).

Many of the most bothersome aspects of osteoarthritis are caused not by the disease itself, but by lack of exercise. Not only can exercise reduce pain, improve function and keep the joints mobile, it also strengthens the surrounding muscles, which provide extra joint support (Virginia, 2000).

OA is a chronic and degenerative disease that often requires long-term management, but can be difficult for patients to sustain long-term. The frequency and intensity of the care can require many staff resources (Victor et al., 2008; Mclean, Burton, Bradley & Littlewood, 2010). Patients who live at a distance may find it difficult to attend clinic regularly due to time factors and the cost of transportation (World Health Organization [WHO], 2003; Nelson, O'Reilly & Miller, 1995). This study therefore investigated the effectiveness of convenient telephone-based physiotherapy wherein therapists provided information for individualized therapeutic exercises to patients at home (Marie-Madeleine et al., 2009).

CHOICE OF TECHNOLOGY

Tele-physiotherapy employs information and communication technologies to facilitate the rehabilitation of patients within their own homes. This approach meets the needs of many elderly patients, especially those who live in remote locations (Victor et al., 2008). Basically, the objective of tele-physiotherapy is to allow medical experts to manage their patients through telecommunication technologies without requiring patients to travel to the clinic (Panachit, Yu & Eng, 2009).

There is precedence for employing tele-physiotherapy. Prior studies have demonstrated the appropriateness and effectiveness of the tele-physiotherapy platform for stroke rehabilitation (Zhou, Hu & Harris, 2006; Zheng, Davies & Black, 2005). Most recently, Russell (2011) documented that tele-physiotherapy can be used to provide effective rehabilitation services for patients with total knee replacement.

However, there are few studies that have investigated the effectiveness of tele-physiotherapy for the management of patients with osteoarthritis of the knee as in the current study. Bennell et al. (2013) investigated nurse delivered telephone coaching sessions to persons with OA, 6-12 times during the 6-month period, however, unlike the current study; these were designed to augment physiotherapy.

METHOD

RESEARCH DESIGN

This study was designed as a randomized clinical trial. Ethical approval was provided by the Research Ethics Committee of University of Ibadan/University College Hospital (UI/UCH), Ibadan, Nigeria, and informed consent was obtained from each participant.

Participants constituted patients diagnosed with knee osteoarthritis (OA) attending out-patient physiotherapy clinics in three health care facilities in Nigeria: University College Hospital, Ibadan; Neuropsychiatric Hospital, Aro, Abeokuta; and State Hospital, Ijaye, Abeokuta. The patients were assessed and screened according to the exclusion and inclusion criteria. Inclusion criteria were as follows: diagnosis of OA of the knee joint; literacy in English or Yoruba language; and, the means to communicate via mobile telephone. Exclusion criteria included co-morbidities that might influence overall well-being, (e.g., cancer, uncontrolled hypertension and diabetes) and cognitive or mental impairment.

THERAPY CONDITIONS

The participants were randomly assigned into either a tele-physiotherapy group (TG) or a clinic group (CG) using a computer generated table of random numbers.

TELE-PHYSIOTHERAPY GROUP

Participants treated by phone-based tele-physiotherapy underwent the following regimen. The Visual Analogue Scale (VAS) and Ibadan Knee/Hip Osteoarthritis Outcome Measure (IKHOAM) were administered to assess pain intensity and level of physical function at baseline, respectively. These assessments were

performed in the clinic. Thereafter, participants were taken through graphical diagrammatic representation of standardized home-exercise programs for patients with knee OA (Zelman, 2013). Each was given a copy of the standardized home program to serve as a guide while performing the exercises at home. These knee OA specific exercises were to be performed by the patients at home three times per week for 6-weeks.

Physiotherapists monitored and coached patients in this group via the mobile telephone guide three times per week. The therapists employed uniform statements from a structured telephone intervention guide. Patients were also provided with an exercise log-book to document their exercise procedure. This group of patients reported to the physiotherapy clinic at the second, fourth and sixth weeks of the study for an in-person re-assessment of their pain intensity and level of physical function by re-administration of the VAS and IKHOAM respectively.

CLINIC-BASED GROUP

Patients with knee osteoarthritis in this group were treated in the physiotherapy clinic for a 6-week duration. Pain intensity and level of physical function of these patients were also assessed at baseline using VAS and IKHOAM respectively. However, the physiotherapists, (not patients), administered the standardized exercise program in the clinic, three times a week for 6 weeks. These participants did not receive additional support or communication from the physiotherapist via mobile telephone outside of their clinic visits. The patients in this group were also re-assessed for pain intensity and level of physical function at the second, fourth and sixth weeks of the intervention period using VAS and IKHOAM respectively.

OUTCOME MEASURES

English and Yoruba language versions of the outcome measures were used during the assessment procedure in both groups.

IBADAN KNEE/HIP OSTEOARTHRITIS OUTCOME MEASURE (IKHOAM)

The Ibadan Knee/Hip Osteoarthritis Outcome Measure (IKHOAM) and its Yoruba translated version were developed to reflect the environment and culture of Nigerians, because some of the existing osteoarthritis (OA) outcome measures included some items that may not be readily understood by Nigerians, especially those with low educational attainments. Almost all existing OA outcome measures excluded activities that are important to many patients seen in Nigerian clinics (e.g., incomplete kneeling/prostrating to show courtesy/greet elders, sitting on the heels (Islamic praying posture), using pit/Asiatic

toilet, etc.) (Akinpelu et al., 2007). The objective of this scale is to assess physical function and end results of care in patients with knee and/or hip OA.

The IKHOAM is a three-part 33 items questionnaire that is both patient (self) and clinician administered, taking approximately 15 minutes to complete. The score range is 0-232; a higher score indicates higher functioning. The IKHOAM is available in English and three main Nigerian languages (Yoruba, Igbo and Hausa), along with evidence of psychometric properties. The Yoruba version was developed to encourage the use of the IKHOAM in Southwestern region of Nigeria. The IKHOAM (English Version) was correlated with the Yoruba version and visual analogue scale (VAS).

The validity of the Yoruba IKHOAM was found to be satisfactory and comparable to the original version ($r = 0.67$, $p = 0.005$) for the criterion-related validity and ($r = -0.31$, $p = 0.005$) for construct validity. The items in the Yoruba IKHOAM correlated well with each other with Cronbach's alpha coefficient ranging between 0.69 and 0.99. The Yoruba IKHOAM, like the original version, is a reliable, consistent and valid instrument that can be considered for use in the Nigeria environment for evidence-based quality health care promotion in patients with knee/hip OA (Odole, Akinpelu & Bamgboye, 2006; Odole & Akinpelu, 2008; Odole & Akinpelu, 2010).

VISUAL ANALOGUE SCALE (VAS)

The Visual Analogue Scale (VAS) and its Yoruba translated version measures the amount of pain that a patient feels. It ranges across a continuum from none to an extreme amount of pain. The VAS used in this study was a horizontal line, 100 mm in length, anchored by word descriptors at each end (i.e., no pain; worst pain possible). A higher score correlated with higher pain intensity and a lower score correlated with lower pain intensity. Patients marked on the line the point that they felt represented their current pain state. The VAS score was determined by measuring in millimeters from the left hand end of the line to the point that the patient marked (Gould, 2001). The VAS has reliable translated anchors in the three Nigerian major languages (Yoruba, Igbo and Hausa). Odole and Akinpelu (2009) assessed the alternate forms of reliability of the VAS in these Nigerian major languages and documented positive correlations between each of the translated anchors and the original English version. For Yoruba translated version, the reliability is acceptable ($r = 0.65$; $p < 0.05$); it is therefore recommended for use in Nigerian clinical settings (Odole & Akinpelu, 2009).

DATA ANALYSES

Analysis of variance (ANOVA) was used to compare pain intensity and physical function at baseline, second, fourth and sixth week of intervention in the two treatment groups (clinic-based and tele-physiotherapy groups). Where there were statistically significant differences after using ANOVA, the post-hoc analysis of Least Square Difference (LSD) was used to locate exactly where these differences occurred. The independent t-test was used to compare each dependent variable (pain and physical function) between the two treatment groups (clinic-based and tele-physiotherapy groups) at baseline, second, fourth and sixth week of intervention. Trend of variables (pain and physical function) were also presented using graphs. The level of significance was set at 0.05.

RESULTS

PARTICIPANT DEMOGRAPHICS

Fifty patients with osteoarthritis of the knee (26 males and 24 females) participated in the study. Their ages ranged from 37 years to 72 years with a mean age of 55.50 ± 7.55 years. There was one participant (female) between the age range of 30 – 39, eleven participants (6 males and 5 females) between age range of 40 – 49, twenty participants (10 males and 10 females) between age range of 50 – 59, seventeen participants (10 male and 7 females) between age range of 60 – 69 and one participant (female) between age range of 70 – 79.

Twenty five patients (12 males and 13 females) were in the clinic group (CG) with a mean age of 54.96 ± 7.81 years and also an equal number (14 males and 11 females) were in the tele-physiotherapy group (TG) with a mean age of 56.04 ± 7.40 years. Both groups were comparable in their ages at baseline ($p = 0.62$) (Table 1).

Table 1. Demographics of Participants

Group	N	Age Mean \pm SD (Years)	t	P-Value
CG	25	54.96 ± 7.81	-0.502	0.62
TG	25	56.04 ± 7.40		

Note. CG = Clinic group; TG = Tele-physiotherapy group.
*Significant level is 0.05

PAIN INTENSITY SCORES OF PARTICIPANTS IN THE TELE-PHYSIOTHERAPY GROUP ACROSS BASELINE, SECOND, FOURTH AND SIXTH WEEK OF INTERVENTION

The mean pain intensity scores of the participants in the tele-physiotherapy group (TG) were significantly different across baseline (54.68 ± 18.38), second (45.36 ± 15.79), fourth (34.36 ± 16.43) and sixth-week (22.40 ± 13.76) of intervention (Table 2). The result of the post hoc test (Least Square Difference) indicated that there were significant differences in pain intensity scores in the tele-physiotherapy group between all the weeks when paired repeatedly (Table 3). Trend of pain intensity following six weeks of tele-physiotherapy intervention is represented on a line graph (Figure 1).

Table 2. Pain Intensity Scores of Participants in Tele-physiotherapy Group across Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	N	Pain Mean \pm SD	F	P-Value
Baseline	25	54.68 ± 18.38	18.580	0.00*
Second Week	25	45.36 ± 15.79		
Fourth Week	25	34.36 ± 16.43		
Sixth Week	25	22.40 ± 13.76		

*Significant level is 0.05

Table 3. Post Hoc Test (Least Square Difference) for Pain Intensity Scores in the Tele-physiotherapy Group across Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	P-Value
Baseline – Second week	0.04*
Baseline – Fourth week	0.00*
Baseline – Sixth week	0.00*
Second – Fourth week	0.02*
Second – Sixth week	0.00*
Fourth – Sixth week	0.01*

* Significance level is 0.05

PAIN INTENSITY SCORES OF PARTICIPANTS IN THE CLINIC GROUP ACROSS BASELINE, SECOND, FOURTH AND SIXTH WEEK OF INTERVENTION

The mean pain intensity scores of the participants in the clinic group (CG) were significantly different across baseline (55.84 ± 17.83), second (43.56 ± 17.36), fourth (30.44 ± 18.22) and sixth week (18.84 ± 15.99) of intervention (Table 4). The result of the post hoc test (Least Square Difference) indicated that there were significant differences in pain intensity scores in the clinic group between all the weeks when paired repeatedly (Table 5). Trend of pain intensity following six weeks of clinic intervention is represented on a line graph (Figure 1).

Table 4. Pain Intensity Scores of Participants in the Clinic Group across Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	N	Pain Mean \pm SD	F	P-Value
Baseline	25	55.84 \pm 17.83	21.284	0.00*
Second Week	25	43.56 \pm 17.36		
Fourth Week	25	30.44 \pm 18.22		
Sixth Week	25	18.84 \pm 15.99		

*Significant level is 0.05

Table 5. Post Hoc Test (Least Square Difference) for Pain Intensity Scores in the Clinic Group across Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	P-Value
Baseline – Second week	0.01*
Baseline – Fourth week	0.00*
Baseline – Sixth week	0.00*
Second – Fourth week	0.01*
Second – Sixth week	0.00*
Fourth – Sixth week	0.02*

* Significance level is 0.05

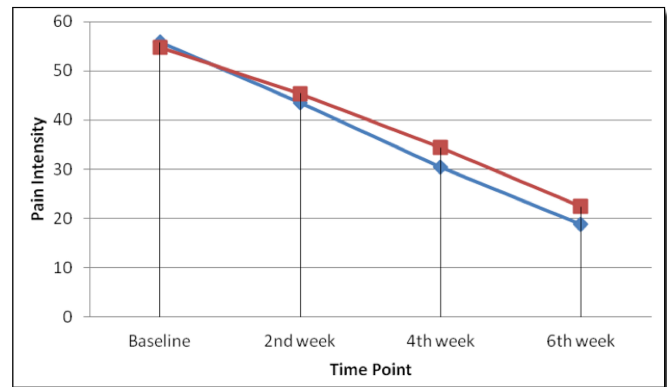


Figure 1. Line graph showing trends of pain intensity following six weeks of tele-physiotherapy and clinic interventions.

PHYSICAL FUNCTION SCORES OF PARTICIPANTS IN THE TELE-PHYSIOTHERAPY GROUP ACROSS BASELINE, SECOND, FOURTH AND SIXTH WEEK OF INTERVENTION

The mean physical function scores of the participants in the tele-physiotherapy group (TG) were significantly different across baseline (72.84 ± 11.44), second (76.25 ± 10.62), fourth (80.32 ± 10.45) and sixth week (83.70 ± 10.26) of intervention (Table 6). The result of the post hoc test (Least Square Difference) indicated that there were significant differences in physical function scores in the tele-physiotherapy group between baseline and fourth week (72.84 ± 11.44 vs. 80.32 ± 10.45), baseline and sixth week (72.84 ± 11.44 vs. 83.70 ± 10.26), and second and sixth week (76.25 ± 10.62 vs. 83.70 ± 10.26). However, there were no significant differences between baseline and second week (72.84 ± 11.44 vs. 76.25 ± 10.62), second week and fourth week (76.25 ± 10.62 vs. 80.32 ± 10.45), and fourth and sixth week (80.32 ± 10.45 vs. 83.70 ± 10.26) (Table 7). Trend of physical function following six weeks of tele-physiotherapy intervention is represented on a line graph (Figure 2).

Table 6. Physical Function Scores of Participants in the Tele-physiotherapy Group across Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	N	Pain Mean±SD	F	P-Value
Baseline	25	72.84 ± 11.44	4.895	0.00*
Second Week	25	76.25 ± 10.62		
Fourth Week	25	80.32 ± 10.45		
Sixth Week	25	83.70 ± 10.26		

*Significant level is 0.05

Table 8. Physical Function Scores of Participants in the Clinic Group across Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	N	Pain Mean±SD	F	P-Value
Baseline	25	70.73 ± 15.54	5.584	0.00*
Second Week	25	75.60 ± 12.96		
Fourth Week	25	80.36 ± 11.76		
Sixth Week	25	84.87 ± 10.79		

*Significant level is 0.05

Table 7. Post Hoc Test (Least Square Difference) of Physical Function Scores of Participants in the Tele-physiotherapy Group across Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	P-Value
Baseline – Second week	0.26
Baseline – Fourth week	0.02*
Baseline – Sixth week	0.00*
Second – Fourth week	0.18
Second – Sixth week	0.02*
Fourth – Sixth week	0.27

* Significance level is 0.05

Table 9. Post Hoc Test (Least Square Difference) of Physical Function Scores in the Clinic Group across Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	P-Value
Baseline – Second week	0.19
Baseline – Fourth week	0.01*
Baseline – Sixth week	0.00*
Second – Fourth week	0.20
Second – Sixth week	0.01*
Fourth – Sixth week	0.22

* Significance level is 0.05

PHYSICAL FUNCTION SCORES OF PARTICIPANTS IN THE CLINIC GROUP ACROSS BASELINE, SECOND, FOURTH AND SIXTH WEEK OF INTERVENTION

The mean physical function scores of the participants in the clinic group (CG) were significantly different across baseline (70.73 ± 15.54), second (75.60 ± 12.96), fourth (80.36 ± 11.76) and sixth week (84.87 ± 10.79) of intervention (Table 8). The result of the post hoc test (Least Square Difference) indicated that there were significant differences in physical function scores in the clinic group between baseline and fourth week (70.73 ± 15.54 vs. 80.36 ± 11.76), baseline and sixth week (70.73 ± 15.54 vs. 84.87 ± 10.79), and second and sixth week (75.60 ± 12.96 vs. 84.87 ± 10.79). However, there were no significant differences between baseline and second week (70.73 ± 15.54 vs. 75.60 ± 12.96), second week and fourth week (75.60 ± 12.96 vs. 80.36 ± 11.76), and fourth and sixth week (80.36 ± 11.76 vs. 84.87±10.79) (Table 9). Trend of physical function following six weeks of clinic intervention is represented on a line graph (Figure 2).

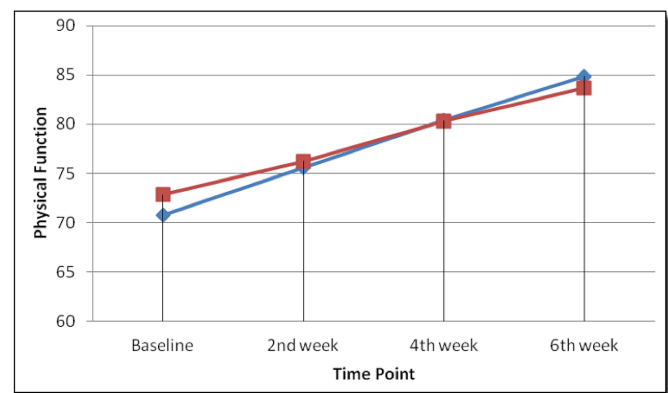


Figure 2. Line graph showing trends of physical function following six weeks of tele-physiotherapy and clinic interventions.

BETWEEN-GROUP COMPARISON OF PARTICIPANTS' PAIN INTENSITY AT BASELINE, SECOND, FOURTH, AND SIXTH WEEK OF INTERVENTION

The mean pain intensity scores of the participants in the two groups (CG vs. TG) were not significantly different at baseline (55.84 ± 17.83 vs. 54.68 ± 18.38), second (43.56 ± 17.36 vs. 45.36 ± 15.79), fourth (30.44 ± 18.21 vs. 34.36 ± 16.43) and sixth week (18.84 ± 15.99 vs. 22.40 ± 13.76) of intervention (Table 10). Between-group comparison of participants' pain intensity at baseline, second, fourth and sixth week of intervention is represented on a bar chart (Figure 3).

Table 10. Between Group Comparison of Participants' Pain at Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	Group	N	Pain Mean±SD	t	P-Value
Baseline	CG	25	55.84 ± 17.83	0.226	0.82
	TG	25	54.68 ± 18.38		
Second Week	CG	25	43.56 ± 17.36	-0.383	0.70
	TG	25	45.36 ± 15.79		
Fourth Week	CG	25	30.44 ± 18.21	-0.799	0.41
	TG	25	34.36 ± 16.43		
Sixth Week	CG	25	18.84 ± 15.99	-0.844	0.40
	TG	25	22.40 ± 13.76		

*Significant level is 0.05

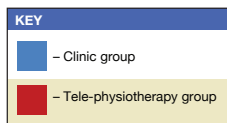
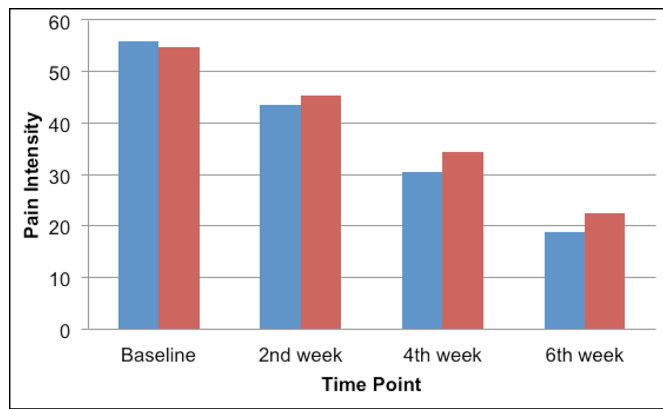


Figure 3. Bar chart showing between-group comparisons of participants' pain following six weeks of intervention.

BETWEEN-GROUP COMPARISON OF PARTICIPANTS' PHYSICAL FUNCTION AT BASELINE, SECOND, FOURTH, AND SIXTH WEEK OF INTERVENTION

The mean physical function scores of the participants in the two groups (CG vs. TG) were not significantly different at baseline (70.73 ± 15.54 vs. 72.84 ± 11.44), second (75.60 ± 12.96 vs. 76.25 ± 10.62), fourth (80.36 ± 11.76 vs. 80.32 ± 10.45) and sixth week (84.87 ± 10.79 vs. 83.70 ± 10.26) of intervention (Table 11). Between-group comparison of participants' physical function at baseline, second, fourth and sixth week of intervention is represented on bar charts (Figure 4).

Table 11. Between Group Comparison of Participants' Physical Function at Baseline, Second, Fourth and Sixth Week of Intervention

Time Point	Group	N	Pain Mean±SD	t	P-Value
Baseline	CG	25	70.73 ± 15.54	-0.546	0.59
	TG	25	72.84 ± 11.44		
Second Week	CG	25	75.60 ± 12.96	-0.194	0.84
	TG	25	76.25 ± 10.62		
Fourth Week	CG	25	80.36 ± 11.76	0.013	0.99
	TG	25	80.32 ± 10.45		
Sixth Week	CG	25	84.87 ± 10.79	0.391	0.70
	TG	25	83.70 ± 10.26		

*Significant level is 0.05

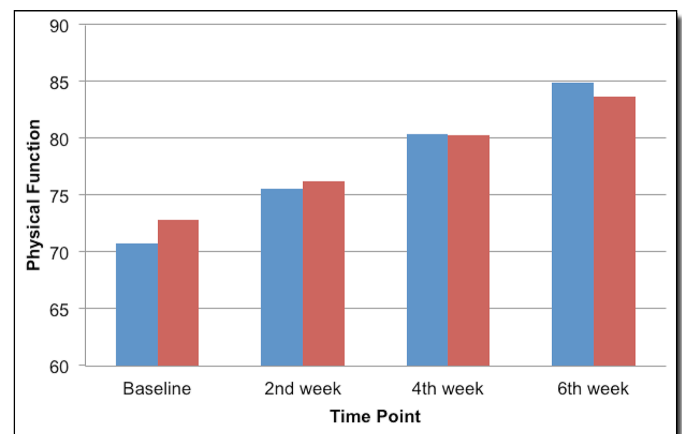


Figure 4. Bar chart showing between-group comparisons of participants' physical function following six weeks of intervention.

DISCUSSION

This study investigated the effects of a 6-week tele-physiotherapy program on pain intensity and physical function of patients with osteoarthritis of the knee. There were no significant differences in pain intensity and physical function between patients with knee osteoarthritis (OA) in the tele-physiotherapy group and the clinic-based physiotherapy group at baseline, second, fourth and sixth week of intervention.

It appears there are no comparable published data on the effect of tele-physiotherapy among individuals with knee osteoarthritis in Nigeria. Thus, comparisons on the findings from this study can only be made with related studies from different countries and with different patient populations.

Scherr et al. (2009) documented the effect of home-based telemonitoring using mobile phone technology on the outcome of patients with heart failure after an episode of acute decompensation in 108 patients (79 males and 29 females; age range of 18 – 80 years). Patients were randomly allocated to pharmacological treatment (control group) or to pharmacological treatment with telemedical surveillance (tele group) for 6 months. Tele group patients were trained to measure vital parameters (blood pressure, heart rate, body weight) on a daily basis at the same time, preferably in the morning after emptying the bladder and before dressing and taking medication. Thereafter, patients were advised to enter these values as well as their dosage of heart failure medication into the mobile phone's Internet browser and send them to the monitoring center. The study concluded that telemonitoring using mobile phones as patient terminals has the potential to reduce frequency and duration of heart failure hospitalization. Similar to this study, our study demonstrated positive benefits ($p < 0.05$) associated with using telehealth technologies to support patient care.

Likewise, Russell (2011) enrolled 65 patients who underwent total knee replacement (TKR) and randomized them to receive six weeks of either traditional outpatient rehabilitation services or Internet-based outpatient rehabilitation (tele-rehab group). Patients in the tele-rehabilitation group received rehabilitation exercises (open and closed kinetic loop active exercises) through real-time (live video and audio) interaction with a physical therapist via an Internet-based system. Therapy sessions were limited to 45 minutes. The study showed that participants in the tele-rehab group achieved outcomes comparable to those of the conventional rehabilitation group. This result is similar to the result of comparable pain and physical function outcomes between patients with knee OA in tele-physiotherapy and clinic groups in our study.

Our study also showed that there were significant differences in pain intensity of patients with knee osteoarthritis in the tele-physiotherapy group across baseline, second, fourth and sixth week of intervention. Likewise, there were significant differences in physical

function between weeks 0 – 4, 0-6 and 2-6 following 6 weeks of tele-physiotherapy intervention. These results are consistent with the outcome of a study conducted by Multani, Singh & Garg (2006). They investigated the effectiveness of telemedicine for the management of patients' physiotherapeutic needs while maintaining high quality care and services. Statistically significant ($p < 0.05$) improvements were found in pain, muscle strength and functional capacity in patients with low back pain pre and post 4 weeks of telerehabilitation. Treatment consisted of heat therapy, back exercises, and ergonomics explained through videoconferencing. Telephone, e-mail, videotapes and CDs were also used in the study.

Summarily, our study shows that the outcomes of pain and physical function in patients with osteoarthritis of the knee under tele-physiotherapy treatment (self-administered osteoarthritis specific exercises and telephone monitoring) are comparable to those in the clinic based group (physiotherapist administered osteoarthritis specific exercises) following six weeks of intervention. Additionally, there were significant improvement in pain and physical function in patients with osteoarthritis of the knee following 6-week of tele-physiotherapy intervention.

The clinical importance of the findings of our study includes the practicality and effectiveness of tele-physiotherapy in the management of knee osteoarthritis. This method of treatment would undoubtedly reduce clinic visits, clinic waiting time, and costs incurred from transportation to the clinic, especially for patients living a distance from the clinic. With the use of tele-physiotherapy, more patients with osteoarthritis of the knee could benefit from physiotherapy services.

Future research might explore whether comparable improvements would have occurred in the absence of outcome assessments at weeks two and four, and, if a group of participants might have shown similar improvement without any intermediate testing, therapy, or phone-based intervention. Additional variables for future consideration include the telephone interaction time (e.g., patient-talking time vs. physiotherapist talking time) and the functional content of the interactions (e.g., monitoring vs. instructional; including the degree to which participants engaged in self-assessment).

CONCLUSION

Tele-physiotherapy is effective in management of patients with knee osteoarthritis as evident from the findings of our study which showed significant improvements in pain intensity and physical function of patients with knee osteoarthritis following six weeks of tele-physiotherapy intervention. Also, tele-physiotherapy intervention in patients with osteoarthritis of the knee produces similar outcomes of pain and physical function to 'usual' clinic based physiotherapy as documented in our research where there were no significant differences between patients with knee osteoarthritis (OA) in the tele-physiotherapy group and clinic-based physiotherapy group in pain intensity and physical function following six weeks of tele-physiotherapy intervention.

RECOMMENDATION

Based on the findings of this study, the use of tele-physiotherapy in the management of patients with osteoarthritis of the knee should be integrated into clinical practice. Additionally, more research should be carried out on the effectiveness of tele-physiotherapy in the management of other conditions amenable to physiotherapy.

REFERENCES

1. Akinpelu, A.O., Odole, A.C., Adegoke, B.O.A., & Adeniyi, A.F. (2007). Development and initial validation of Ibadan Knee/Hip Osteoarthritis Outcome Measure (IKHOAM). *South African Journal of Physiotherapy*, 63, 3-8.
2. American Telemedicine Association. (2013). *Telemedicine frequently asked questions (FAQs)*. Retrieved from <http://www.americantelemed.org/learn/what-is-telemedicine/faqs>
3. Bennell, K.L., Egerton, T., Bills, C., Gale, J., Kolt, G.S., Bunker, S.J., ...Hinman, R.S. (2012). Addition of telephone coaching to a physiotherapist-delivered physical activity program in people with knee osteoarthritis: a randomised controlled trial protocol. *BMC Musculoskeletal Disorder*, 13, 246. doi: 10.1186/1471-2474-13-246.
4. Centers for Disease Control and Prevention (2009). *Osteoarthritis*. Retrieved from <http://www.cdc.gov/arthritis/>
5. Doherty, M. (2002). *Pain in osteoarthritis*. International Association for the Study of Pain. Seattle: Press.
6. Gould, D. (2001). Visual analogue scale. *Journal of Clinical Nursing*, 10, 697-706.
7. Guccione, A.A., Felson, D.T., Anderson, J.J., Anthony, J.M., Zhang, Y., & Wilson, P.W. (1994). The effects of specific medical conditions on the functional limitations of elders in the Framingham Study. *American Journal of Public Health*, 84, 351-358.
8. Hunter, D., & Felson, D. (2006). Osteoarthritis: Effective pain management for patients with arthritis. *British Medical Journal*, 332, 639-642.
9. Jamtvedt, G., Dahm, K.T., Christie, A., Moe, H. R., Haavardsholm, E., Holm, I., & Haen, B.,K. (2008a). Physical therapy interventions for patients with osteoarthritis of the knee: An overview of systematic reviews. *Physical Therapy*, 88, 123-136.
10. Jamtvedt, G., Dahm, K.T., Holm, I., & Flottorp, S. (2008b). Measuring physiotherapy performance in patients with osteoarthritis of the knee: A prospective study. *BioMed Central Health Services Research*, 8, 145. doi:10.1186/1472-6963-8-145. Retrieved from <http://www.biomedcentral.com/1472-6963/8/145>.
11. Marie-Madeleine, B., Janson, F., Parminder, K. F., Guy, E. J., Faulkner, L. M., & Mathias, F. M. (2009). Videoconference-based physiotherapy and tele-assessment for homebound older adults: A pilot study. *Activities, Adaptation and Aging*, 33, 139-148.
12. Mclean, S., Burton, M., Bradley, L., & Littlewood, C. (2010). Interventions for enhancing adherence with physiotherapy: A systematic review. *Manual Therapy*, 15, 514-521.
13. Mody, G., & Woolf, A. (2003). A report on the global burden musculoskeletal disorders. Business briefing of European Pharmacotherapy Association. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.200.7777&rep=rep1&type=pdf>
14. Multani, N.K., Singh, B., & Garg, S. (2006). Effectiveness of telemedicine services integrated into physiotherapeutic health care system. *Journal of Exercise Science and Physiotherapy*, 2, 87-91.
15. Nelson, B.W., O'Reilly, E., & Miller M. (1995). The clinical effects of intensive, specific exercise on chronic low back pain: A controlled study of 895 consecutive patients with 1-year follow up. *Orthopedics*, 18, 971-981.

16. Odole, A.C., & Akinpelu, A.O. (2008). Validity and internal consistency of a Hausa version of the Ibadan Knee/Hip Osteoarthritis Outcome Measure. *Health and Quality of Life Outcomes*, 6, 86.
17. Odole, A.C., & Akinpelu, A.O. (2009). Translation and alternate forms reliability of the visual analogue scale in the three major Nigerian Languages. *Internet Journal of Allied Health Sciences and Practice*, 7, 3.
18. Odole, A.C., & Akinpelu, A.O. (2010). Translation of the Ibadan Knee/Hip Osteoarthritis Outcome Measure into Igbo language. *African Journal of Biomedical Research*, 13, 169-175.
19. Odole, A.C., Akinpelu, A.O., & Bamgboye, E.A. (2006). Validity and internal consistency of a Yoruba version of the Ibadan Knee/Hip Osteoarthritis Outcome Measure (Yoruba IKHOAM). *African Journal of Medicine and Medical Science*, 35, 349-357.
20. Ogunlade, S.O., Alonge, T.O., Omololu, A.B., & Adekolujo, O.S. (2005). Clinical spectrum of large joint osteoarthritis in Ibadan, Nigeria. *European Journal of Science and Research*, 11, 116-122.
21. Panachit, K., Yu, X., & Eng, H. (2009). Computer vision technologies for monitoring system in tele-physiotherapy. *Proceedings of the 3rd International Convention on Rehabilitation Engineering & Assistive Technology*, 15. doi: 10.1145/1592700.1592718
22. Russell, T. (2011). Tele-rehabilitation as successful as out-patient physiotherapy post total knee replacement. *Journal of Bone and Joint Surgery*, 93, 113-120.
23. Scherr, D., Kastner, P., Kollmann, A., Hallas, A., Auer, J., Krappinger, H., ... Fruhwald, M. F. (2009). Effect of home-based telemonitoring using mobile phone technology on the outcome of heart failure patients after an episode of acute decompensation: Randomized controlled trial. *Journal of Medical Internet Research*, 11(3), e34. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2762855/>
24. Victor, F.S.F, Sum, Z. H., Aung, A. P. W., Maniyeri, J., Jit, B, Lee, S., & Philip, Y. (2008). Innovative platform for tele-physiotherapy. *Proceedings of the 10th International IEEE Conference*. doi:10.1109/HEALTH.2008.4600111. ISBN: 978-1-4244-2280-7.
25. Virginia, F. (2000). Rehabilitative exercises for patients with knee osteoarthritis, 3(12), 847-848. Retrieved from http://www.koreah.co.kr/board_pds/psy_pds/847PHKneeExercises.pdf
26. Warner, J. (2011). Obesity, knee osteoarthritis hurt seniors' life expectancy. Retrieved from <http://www.webmd.com/osteoarthritis/news/20110213/obesity-and-knee-osteoarthritis-hurt-seniors-quality-of-life>
27. World Health Organization. (2003). Adherence to long term therapies - evidence for action. ISBN: 92-4-154599-2. Retrieved from http://www.who.int/chp/knowledge/publications/adherence_full_report.pdf
28. Woolf, A. & Pfleger, B. (2003). Burden of major musculoskeletal conditions. *Bulletin World Health Organization*, 81, 646-656. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2572542/>
29. Zelman, D. (2013). Injection therapy for osteoarthritis: Exercises for OA of the knee. Retrieved from <http://www.webmd.com/osteoarthritis/joint-injections-13/slideshow-knee-exercises>
30. Zheng, H., Davies, R.J. & Black, N.D. (2005). Web based monitoring system for home based rehabilitation with stroke patients. *Proceedings of the 18th International IEEE Conference*.
31. Zhou, H., Hu, H. & Harris, N. (2006). Wearable inertial sensors for arm motion tracking in home-based rehabilitation. *Proceedings of the 9th International Conference on Intelligent Autonomous Systems (IAS-9)*, 930-937.