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Research Article

ACTIGRAPHY TO EVALUATE CHANGES IN PHYSICAL ACTIVITY AFTER AUTOLOGOUS BREAST RECONSTRUCTION - A PROSPECTIVE COMPARISON STUDY

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ABSTRACT

Objectives: The objective of the study was to quantify the time it takes to return to baseline ambulatory status after breast reconstruction using actigraphy devices.

Methods: Actigraphy devices were used to evaluate preoperative and postoperative physical activity levels in patients undergoing autologous breast reconstruction at a tertiary care institution. Steps and resting heart rate (HR) were used as metrics of physical activity and physiological state. "Baseline" physical activity was defined by the average daily step count during the 14 days before surgery. "Return to baseline" occurred when the 7-day daily step average was greater than or equal to 95% of their baseline steps. SPSS (version 22.0) was used for analysis.

Results: From May 2020 to April 2021, 30 patients were enrolled in the study before deep inferior epigastric perforator breast reconstruction. The mean age was 49.2 years and mean body mass index was 28.6. This cohort averaged 7918±3271 pre-operative steps. Two patients returned to baseline activity by post-operative day 28. In total, eight patients returned by postoperative week 8. Pre-operative resting HR average was 73.4±9.33 beats/min. Actigraphy data demonstrated an initial decrease in activity, increase in sleep variability and increased HR that approached the patients' pre-operative normalized data as they recovered over time.

Conclusions: These data demonstrate that actigraphy data would be of interest to patients making breast reconstruction decisions and that the data can be successfully collected to inform decision-making. These findings indicate that surgeons may underestimate the impact of surgery on physical decline and, consequently, may undertreat with venous thromboembolism prophylaxis.

Keywords: Actigraphy, Mastectomy, Mammoplasty, Quality of life, Surgical flaps, Breast reconstruction, Thromboembolism.

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INTRODUCTION

Breasts are important anatomical structures that symbolize femininity for women. Symmetry, natural shape, and proper size are biologically and aesthetically important. An extremely large breast size may lead to difficulties in daily life and studies have demonstrated that physical weight and psychological factors may cause an altered skeletal posture [1-3]. Moreover, many studies have reported that having both breasts is important in maintaining a center of gravity and stable posture [4]. In the treatment of unilateral breast cancer, oncological safety is the primary goal; however, breast reconstruction surgery to esthetically resemble the natural look of the contralateral healthy breast is also essential. In several studies, it was reported that scoliosis of the spine may be induced when only mastectomy is performed unilaterally [5,6]. Moreover, recent studies have reported that immediate breast reconstruction leads to decreased postoperative postural change compared to mastectomy-only [6]. When selecting the appropriate method of immediate breast reconstruction (autologous tissue transfer, direct-to-implant, and tissue expander), various factors such as the patient's biotype, breast shape, size, other comorbidities, and preference are considered [7]. Among the many surgical methods, unilateral autologous tissue transfer of the latissimus dorsi (LD) flap, which is the most commonly used autologous tissue, is a common breast reconstruction method in patients with a small-to-moderate breast size in Asian. Studies have reported the functional outcomes of this method [8]; however, there are only a few reports on how reconstruction correlates with alteration in skeletal posture. The purpose of this study was to examine postural and functional changes after breast reconstruction after using actigraphy devices.

METHODS

From May 2020 to April 2021, an experimental group of 30 patients who underwent breast reconstruction using a LD flap immediately after mastectomy were enrolled. Patients' characteristics (age, body mass index [BMI], excised mass weight, etc.) were collected preoperatively. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The Institutional Review Board of Kyungpook National University Chilgok Hospital (No. 2018-02-007-003) approved this prospective study and all patients provided informed consent to have their data recorded, analyzed, and published for research purposes.

This prospective randomized study included patients (I) with diagnosed breast cancer, (II) who underwent immediate reconstruction after a breast cancer operation or received a mastectomy only, and (III) were aged 30–60 years at the time of the operation. This study excluded patients (I) diagnosed with advanced-stage III or IV breast cancer, (II) who were unable to answer the self-questionnaire due to cognitive impairment, (III) with a history of neurologic disorders or musculoskeletal problems on the trunk and the upper extremity, and (IV) with a history of alcohol or drug abuse surgery. "Return to baseline" occurred when the 7-day daily step average was ≥95% of their baseline steps. SPSS (version 22.0) was used for analysis.

Women undergoing immediate free flap or pre-pectoral tissue expander placement after early stage breast cancer (Stage 0–II), who would not require axillary dissection, who owned a smartphone, had WiFi, and were willing to wear a smart watch were eligible for inclusion. Recruitment occurred during a reconstructive consultation 2–3 weeks

after receiving their breast cancer diagnosis. The Sensus application (Sensus Mobile UVA Apps LLC, Charlottesville, VA) and the Microsoft Band 2 (Microsoft Corporation, Redmond, WA) smart watch were used to measure patient recovery at 1Hz measurement frequency combined with hourly and daily step and sleep measures from the Microsoft Health application. Each patient wore an actigraphy device for a 2-week baseline period followed by a 3-month post-operative period to assess short-term recovery normalized to the patient's individual pre-operative data. Patient diaries were kept to help interpret the daily activities reflected by the actigraphy devices.

RESULTS

Table 1 actigraphy devices were worn by eight women undergoing immediate implant-based breast reconstruction and eight women undergoing immediate flap reconstruction. Mean age in both groups was 49.2 years and 48.6 years which is comparable ($p>0.05$). As per BMI range patients with expander replacement has normal BMI while those with free flap have higher BMI suggest overweight patients. And this was statistically significant ($p<0.05$). Six patients showed smoking while those taken prior radiation, adjuvant chemotherapy, and radiation undergoes free flap reconstruction.

Fig. 1, Post-operative steps taken after free flap breast reconstruction normalized to 2 week lead-in pre-operative data. Significant early decease in activity with reported pain index 6–10.Step frequency approached pre-operative baseline of 4809 steps per day or 2 miles travelled by Day 21. At 1 week appointment, patient was walking about the 1st floor of their house. At 1 month post-operative visit, she was performing all activities of daily living including walks in the neighborhood.

Fig. 2 pre- and post-operative total and restful sleep hours after bilateral tissue expander placement increased variability in total and restful sleep hours over POD 1–19. Patient endorsed 3 weeks of narcoticuse and daytime naps and then returned to a diurnal schedule similar to baseline after that period.

Fig. 3 heart variability decreases as exhibited by shorter box plots and narrower trend lines of heart rate (HR) range for first 4 days after surgery with patient documenting narcotic use for 7 days. Heart rate variability increases as calculated activity index increases over POD 5–13 and again POD 14–55.

DISCUSSION

Actigraphy data demonstrated a measurable decline in activity and HR variability as well as an increase in sleep variability after breast reconstruction that returned to patient normalized.

Baseline over a short-term recovery period. At present, reconstructive surgery consultations tend to focus on perioperative surgical risks, long-term esthetics, and revision rates with reportable data limited to subjective questionnaires [9]. By combining objective actigraphy data from women after reconstruction with subjective survey data, clinicians may provide a comprehensive picture of post-operative recovery focusing on outcome variables valued by patient [10-12]. Fortunately, an interest in studying real-time patient data parallels patient interest in wearable devices used to measure function for their personal convenience. While different devices vary in performance, validity across devices has been reported for steps travelled, activity levels, and sleep, the main outcome variables of our investigation [13]. Patient-generated data and actigraphy devices have well-documented uses in other medical specialties [14,15]. However, the application of this technology to surgical patients, in general, is limited and in post-mastectomy breast reconstruction, specifically, has not been described. Our report demonstrates that sleep patterns and activity can be measured after breast reconstruction without distracting variability to mask the overall trend. Wearable technology appears to be a promising adjunct to traditional post-operative patient reported outcomes measures. The resultant objective data can be analyzed and compared with validated patient reported outcomes, allowing for predictive modeling, and aiding in future patient decision-making.

Table 1: Demographic and medical parameters of study participants

Variables	Immediate expander (8)	Immediate free flap (8)
Mean age (years)	49.2 (46–54)	48.6 (46–52)
BMI (range)	23.7 (18.7–27.8)	28.6 (21.8–35.9)
Prior radiation	None	2
Adjuvant chemotherapy	0	2
Adjuvant radiation	0	2
Smoking	2	4
Complication	1	0

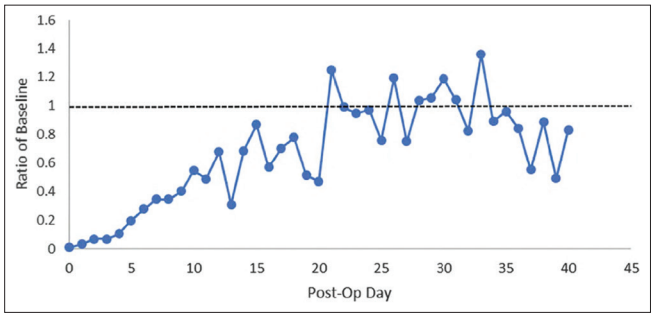

Fig. 1: Post-operative steps taken after free flap breast reconstruction relative pre-operative baseline

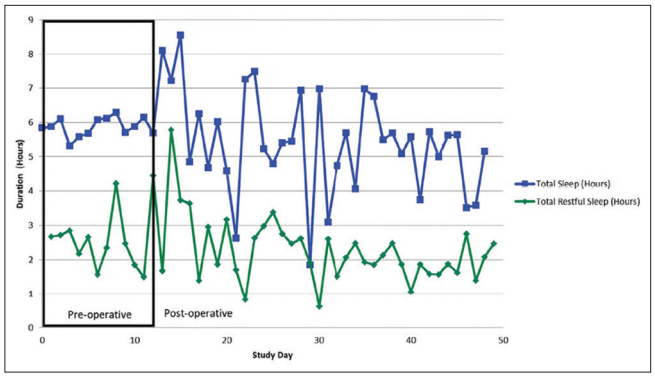

Fig. 2: Pre-operative and post-operative total and restful sleep hours after tissue expander

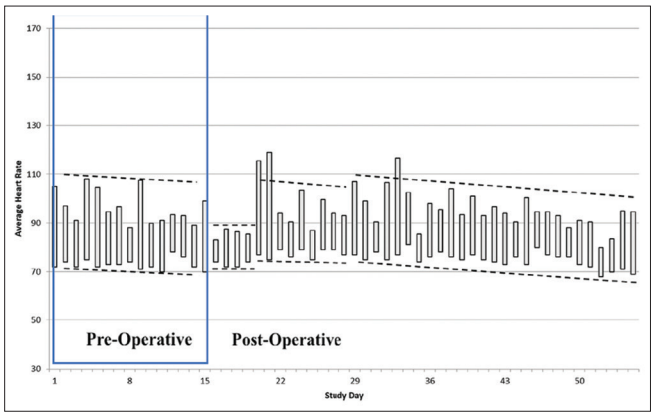

Fig. 3: Pre-operative and post-operative heart rate variability after tissue expander

CONCLUSIONS

These data demonstrate that actigraphy data would be of interest to patients making breast reconstruction decisions and that the data can be successfully collected to inform decision-making. These findings indicate that surgeons may underestimate the impact of surgery on physical decline and, consequently, may undertreat with venous thromboembolism prophylaxis.

AUTHOR'S CONTRIBUTION

Dr. X has finalized the draft and guarantor, Dr. Y and Z has prepared the conceptual framework, designing of draft, and data analysis, Dr. A was involved in data collection and analysis, and Dr. B has done manuscript writing and data collection.

CONFLICT OF INTEREST

None declared.

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REFERENCES

1. Hanuszkiewicz J, Malicka I, Stefańska M, Barczyk K, Woźniewski M. Bodyposture and trunk muscle activity in women following treatment of breast cancer. Ortop Traumatol Rehabil 2011;13:45-57.
2. Malicka I, Barczyk K, Hanuszkiewicz J, Skolimowska B, Woźniewski M. Body postureof women after breast cancer treatment. Ortop Traumatol Rehabil 2010;12:353-61. PMID 20876929.
3. Barbosa AF, Lavoura PH, Boffino CC, Siqueira CM, Costa MP, Lima JE Jr., *et al*. The impactof surgical breast reduction on the postural control of women with breast hypertrophy. Aesthet Plast Surg 2013;37:321-6. doi: 10.1007/s00266-012-0049-1.
4. Barbosa JD, Amorim MH, Zandonade E, Delaprane ML. Evalution of body posture in women with breast cancer. Rev Bras Ginecol Obstet 2013;35:215-20. doi: 10.1590/s0100-72032013000500005, PMID 23843119.
5. Rostkowska E, Bak M, Samborski W. Body posture inwomen after mastectomy and its changes as a result ofrehabilitation. Adv Med Sci 2006;51:287-97. PMID 17357328.
6. Serel S, Tuzlalı ZY, Akkaya Z, Uzun C, Kaya B, Bayar S, *et al*. Physical effects ofunilateral mastectomy on spine deformity. Clin Breast Cancer 2017;17:29-33.
7. Peres AC, Latorre MD, Maesaka JY, Filassi JR, Baracat EC, Ferreira EA. Body posture after mastectomy: Comparison between immediate breast reconstruction versus mastectomy alone. Physiother Res Int 2017;22:e1642. doi: 10.1002/pri.1642, PMID 26375989.
8. Yang JD, Huh JS, Min YS, Kim HJ, Park HY, Jung TD. Physical and functional ability recovery patterns and quality of life after immediate autologous latissimus dorsi breast reconstruction: A 1-yearprospective observational study. Plast Reconstr Surg 2015;136:1146-54. doi: 10.1097/PRS.0000000000001769, PMID 26267396.
9. Lee CN, Belkora J, Chang Y, Moy B, Partridge A, Sepucha K. Are patients making high-quality decisions about breast reconstruction after mastectomy? [outcomes article]. Plast Reconstr Surg 2011;127:18-26. doi: 10.1097/PRS.0b013e3181f958de, PMID 21200195.
10. Pusic AL, Klassen AF, Scott AM, Klok JA, Cordeiro PG, Cano SJ. Development of a new patient-reported outcome measure for breast surger: BREAST-Q. Plast Reconstr Surg 2009;124:345-53.
11. Weichman KE, Hamill JB, Kim HM, Chen X, Wilkins EG, Pusic AL. Understanding the recovery phase of breast reconstructions: Patient-reported outcomes correlated to the type and timing ofreconstruction. J Plast Reconstr Aesthet Surg 2015;68:1370-8. doi: 10.1016/j.bjps.2015.05.039, PMID 26165633.
12. Gahm J, Jurell G, Edsander-Nord Å, Wickman M. Patient satisfactionwith aesthetic outcome after bilateral prophylactic mastectomy and immediate reconstruction with implants. J Plast Reconstr Aesthet Surg. 2010;63:332-8.
13. Evenson KR, Goto MM, Furberg RD. Systematic review of the validity and reliability of consumer-wearable activity trackers. Int J Behav Nutr Phys Act 2015;12:159. doi: 10.1186/s12966-015-0314-1, PMID 26684758.
14. Sadeh A. The role and validity of actigraphy in sleep medicine: An update. Sleep Med Rev 2011;15:259-67. doi: 10.1016/j.smrv.2010.10.001, PMID 21237680.
15. Van Remoortel H, Giavedoni S, Raste Y, Burtin C, Louvaris Z, Gimeno-Santos E, *et al*. Validity of activity monitors in health and chronic disease: A systematic review. Int J Behav Nutr Phys Act 2012;9:84. doi: 10.1186/1479-5868-9-84, PMID 22776399.