

Efficacy of Whole Body Vibration on Post Thyroidectomy Osteoporosis

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Abstract

Purpose: This study was conducted to investigate effect whole body vibration on post thyroidectomy osteoporosis.

Subjects and Methods: Thirty patients with osteoporosis following thyroidectomy were conducted in the present study. All patients with age ranged from 40 to 60 years. They were selected from El-Kasr El-Ainy Hospital and El-Safwa Hospital in Cairo, Egypt.

Patients assigned randomly into two Groups (A and B) equal in number: Group (A) fifteen patients received the routine medical treatment (Bisphosphonates, Calcium and Vitamin D) plus whole body vibration for 12 weeks (3 sessions/week). Group (B) fifteen patients received the recommended routine medical treatment (Bisphosphonates, Calcium and Vitamin D) for 12 weeks.

Evaluations of both groups (A and B) were done before starting the treatment and at the end of study by Dual Energy X-rays (DEXA).

Results: This study showed a statistically significant increase of bone density with percentage of improvement (23.44) in Group (A), compared with Group (B) with percentage of improvement (13.2).

Conclusion: Whole body vibration is an effective modality for improving bone density.

Key Words: *Thyroidectomy – Osteoporosis – DEXA – Whole body vibration.*

Introduction

THYROIDECTOMY is the most frequent intervention in endocrine surgery. When performed in specialized centers, the operation is safe with low morbidity and 0% mortality [1].

After the removal of a thyroid, patients usually take a prescribed oral synthetic thyroid hormone

[levothyroxine (synthroid)] to prevent hypothyroidism [2].

However, TSH suppression was associated with a significantly increased risk of adverse events. Women with suppressed TSH levels were three times as likely to develop osteoporosis compared with those whose levels were not suppressed. Even after adjusting for age—a major factor in osteoporosis—TSH remained a strong predictor for the condition. The risk of osteoporosis appeared to taper with less TSH suppression, but risk of recurrence remained the same. TSH suppression was not linked with a significantly increased risk of atrial fibrillation [9].

Considerable controversy surrounds the role that thyroid disorders play in exacerbating bone loss and the risk of osteoporotic fractures. Bone mass is generally said to be reduced with hyperthyroidism and in many the secretion of calcitonin is dramatically reduced by total or subtotal thyroidectomy and/or radioiodine therapy, and calcitonin deficiency has also been postulated to cause osteopenia [6].

As a physiotherapy method, Whole-Body Vibration (WBV) treatment produces a vibratory stimulation of the entire body for patients standing on a vibrating platform, due to sinusoidal oscillations in vertical or rotational mode. Recent studies have reported that WBV may increase bone formation in animal models, young adults, and children with low Bone Mineral Density (BMD) or physical impairments, promote neuromuscular adaptation and increase muscle strength [11].

Subjects and Methods

This study was started from June 2016 till January 2017 at El-Kasr El-Ainy Hospital and El-Safwa Hospital in Cairo, Egypt.

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Subjects: Thirty patients who had thyroidectomy since 6 months and suffered from osteoporosis. They were selected from El-Kasr El-Ainy Hospital and El-Safwa Hospital and patients were assigned randomly into two groups of equal numbers, (Group A and Group B).

Inclusive criteria: All patients participated in this study were males and females, age ranged between 40 and 60 years, had thyroidectomy since 6 months, suffered from osteoporosis in femur and spine and have sufficient cognition and education enough to understand the requirements of the study.

Exclusive criteria: All patients with thrombosis, had acute inflammation, received pharmacologic intervention for osteoporosis before the starting of treatment, had history of severe musculoskeletal problems, received immunosuppressant, anticonvulsants therapy, suffered from psychological problems or who were alcoholic drinkers were excluded from this study.

Equipment: The study equipment were divided into two different categories, measuring and therapeutic equipment.

Measuring equipment: Evaluation the bone mineral density using Dual Energy X-ray Absorptiometry (DEXA).

Treatment equipment: Whole body vibration apparatus (model power plate-my5™, made in United States) with frequency 30-40Hz was used for whole body vibration program by reciprocating vertical displacements on the left and right side of a fulcrum.

Procedure of application: The subjects will be informed about the nature of the study; each subject signed consent form before participating in the study. Treatment time of the present study was given in the period of 12 weeks.

- **Group A (study group):** Patients in study group treated with WBV 10min, 3 times weekly on a platform set to vibrate at (30Hz and intensity 5mm) with treatment medical treatment intake (12 weeks).

- **Group B (control group):** Patients in control group receive routine medication during the duration of the study (12 weeks).

Patients in control group receive routine medication during the duration of the study. (12 weeks):

Ethical consideration: Confidentiality was assured by signing the consent form and respect

to all patients was ascertained through explaining the objectives of the study and its benefits. The study was approved by Ethical Committee of Faculty of Physical Therapy, Cairo University. (P. T. REC/0 12/001000).

Results

Comparing the general characteristics of the subjects of both groups revealed that there was no significance difference between both groups in the mean age ($p=0.4$).

The sex distribution of the control group revealed that there were 5 males with reported percentage of 33% and 10 females with reported percentage of 67% as shown in (Table 1).

The mean \pm SD age of the control group was 51 ± 5.87 years, with maximum value of 59 years and minimum value of 41 years. There was no significant difference between both groups in the mean age values ($p=0.4$). Table (2).

The mean \pm SD BMD_{pre-treatment} of study group was $2.09 \pm 0.18 \text{ g/cm}^2$ and that post-treatment was $1.6 \pm 0.11 \text{ g/cm}^2$. The mean difference between pre and post-treatment was 0.49 g/cm^2 and the percent of improvement was 23.44%. There was a significant increase in the BMD in the study group post-treatment compared with pre-treatment ($p=0.0001$). (Table 3).

The mean \pm SD BMD_{pre-treatment} of control group was $-2.12 \pm 0.31 \text{ g/cm}^2$ and that post-treatment was $-1.84 \pm 0.3 \text{ g/cm}^2$. The mean difference between pre and post-treatment was -0.28 g/cm^2 and the percent of improvement was 13.2%. There was a significant increase in the BMD in the control group post-treatment compared with pre-treatment ($p=0.0001$).

The mean \pm SD BMD_{post-treatment} of study group was $-1.6 \pm 0.11 \text{ g/cm}^2$ and that of control group was $-1.84 \pm 0.3 \text{ g/cm}^2$. The mean difference between both groups was 0.24 g/cm^2 . There was a significant increase in the BMD in the study group compared with control groups post-treatment ($p=0.009$). (Table 4).

Table (1): Frequency distribution of sex in both groups (study and control).

	Study group		Control group	
	Males	Females	Males	Females
No.	8 (53%)	7 (47%)	5 (33%)	10 (67%)
Total	15 (100%)		15 (100%)	

Table (2): Statistical analysis of mean age and pre-treatment mean values of BMD of study and control groups.

	Study group	Control group
$\bar{X} \pm SD$	49.13±6.25	51±5.87
Minimum	40	41
Maximum	59	59
MD		-1.87
t-value		-0.84
p-value		0.4
Significance		NS

\bar{x} : Mean. t-value : Unpaired t-value.
 SD : Standard Deviation. p-value : Probability value.
 MD : Mean Difference. NS : Non Significant.

Table (3): Statistical comparison between pre and post-treatment mean values of BMD of control and study group.

	BMD ₂ (g/cm ²) $\bar{X} \pm SD$	MD	Percent of improvement	t- value	p- value	Sig.
<i>Study group:</i>						
Pre	-2.09±0.18	-0.49	23.44	-14.03	0.0001	S
Post	-1.6±0.11					
<i>Control group:</i>						
Pre	-2.12±0.31	-0.28	13.2	-9.87	0.0001	S
Post	-1.84±0.3					

\bar{x} : Mean. t-value : Unpaired t-value.
 SD : Standard Deviation. p-value : Probability value.
 MD : Mean Difference. NS : Non Significant.

Table (4): Statistical comparison between post-treatment mean values of BMD of study and control groups.

	BMD (g/cm ²) $\bar{X} \pm SD$	MD	t- value	p- value	Sig.
Study group	-1.6±0.11	0.24	2.8	0.009	S
Control group	-1.84±0.3				

\bar{x} : Mean. t-value : Unpaired t-value.
 SD : Standard Deviation. p-value : Probability value.
 MD : Mean Difference. NS : Non Significant.

Discussion

The current study was designed to evaluate the therapeutic efficacy of whole body vibration in treatment of osteoporosis following thyroidectomy using the parameters involved DEXA as a method of evaluation was measured at different times:

- Pre-treatment application (before treatment).
- Post-treatment application (after 12 weeks of treatment).

Whole-Body Vibration (WBV) has received much attention as a potential anti osteoporotic intervention in recent years. In experimental animal models, WBV was found to lead to anabolic bone changes. Based on these data and the availability

of many different WBV platforms in North America and Europe, optimistic claims that these benefits may translate to humans have been made within the scientific community and in the media. Such claim quickly proliferated to today's information savvy general population and has left many clinicians and patients wondering about the role of WBV in osteoporosis prevention and/or treatment [7].

WBV may provide an even greater stimulus for maintaining or improving bone health (Gusi et al., [5]). The WBV trained 3d weekly with six 1-min exposures (standing with knees flexed to 60- on a platform set at 12.6Hz and 3mm) while the walking group exercised for 3d weekly. The WBV group significantly increased BMD of the femoral neck [10].

Results on WBV therapies are not entirely clear; some studies have shown increases in BMC at the lumbar spine (Dalen et al., [3]), and areal BMD at the femur (Ruck et al., [8]) and (Gilsanz et al., [4]) and the spine.

Therapeutic results of the significant outcomes of Whole body vibration are summarized as follow:

- 1- Improving bone mass density.
- 2- Improving leg muscles strength.
- 3- Improving muscle power and balance.

Positive clinical efficiency of whole body vibration on bone mineral density:

This concept was supported by some previous studies and past literatures that conducted by following authors [4,10,12] :

- Torvinen et al., [10] concluded that 3 to 5 times weekly on a platform set to vibrate at 25 to 45 Hz in ascending order. In spite of a 7.8% gain in jump height, bone mineral content, serum markers of bone turnover, and estimates of bone mass and structure were not affected at any skeletal site. The subjects in the WBV group assumed a series of body positions during the 4-min exposure.
- Gilsanz et al., [4] suggested that several orders of magnitude below that associated with vigorous exercise, increased bone and muscle mass in the weight-bearing skeleton of young adult females with low BMD.
- Wysocki et al., [12] low amplitude high-frequency Whole-Body Vibration (WBV) training is recently receiving much attention for treating low levels of bone mass.

Conclusion:

From the previous results and discussions, it could be concluded that pulsed Whole body vibration improves bone mineral density of patient suffer from osteoporotic changes post thyroidectomy.

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فاعلية إهتزاز الجسم كله على هشاشة العظام بعد إستئصال الغدة الدرقية

الهدف من البحث: أجريت هذه الدراسة لمعرفة تأثير إهتزاز الجسم كله على المرضى الذين يعانون من هشاشة العظام عقب إستئصال الغدة الدرقية.

مواد وآساليب العلاج: لقد شارك فى هذه الرسالة ثلاثون مريض ومريضة ممن يعانون من هشاشة العظام ب عظمة الحوض والفقرات القطنية عقب إستئصال الغدة الدرقية وقد تم إختيارهم من مستشفى القصر العيى ومستشفى الصفوة وذلك بهدف تحديد تأثير إهتزاز الجسم كله عليها. وقد تم تقسيمهن عشوائيا إلى مجموعتين متساويتين فى العدد مجموعة (أ) مجموعة (العلاج الدوائى فقط) لمدة إثنى عشر أسبوع والمجموعة (ب) مجموعة (العلاج الدوائى وإهتزاز الجسم كله) ثلاث مرات بالإسبوع لمدة إثنى عشر أسبوع.

المرضى الذين يعانون من أمراض القلب، أمراض الكلى، أمراض الكبد، مرض البول السكرى، إرتفاع ضغط الدم، والأورام الخبيثة، والأمراض العقلية والنفسية والمرضى الأقل من أربعين عاما والأكثر من ستين عاما قد تم إستبعادهم من هذه الدراسة. وقد تم التقييم لجميع الحالات فى المجموعتين (أ و ب) قبل بداية الدراسة وبعد مرور إثنى عشر أسبوعا ومن خلال فحص قياس هشاشة العظام ومدى الإستجابة للعلاج.

وقد أظهرت النتائج ما يلى: وجود زيادة ذات دلالة إحصائية فى كثافة العظام بعد إثنى عشر أسبوعا من التطبيق العلاجى فى المجموعة (أ)، أيضا كان هناك زيادة ذات دلالة إحصائية فى كثافة العظام بعد إثنى عشر أسبوعا من التطبيق العلاجى فى المجموعة (ب)، وبمقارنة المجموعتين (أ، ب) قبل بداية الدراسة وبعد إنتهاء الدراسة أسفرت النتائج على أنه يوجد فرق ذو دلالة إحصائية عالية فى تحسن كثافة العظام بين المجموعتين (أ، ب) لصالح مجموعة الدراسة (أ)، ومن هنا يمكن الإستنتاج أن تطبيق العلاج من خلال إستخدام العلاج الدوائى مع إهتزاز الجسم كله له التأثير الأفضل عن إستخدام العلاج الدوائى فقط على تحسن كثافة العظام.

ولقد إشمطت هذه الدراسة على إثنى عشر (١٢) مرجعا تم ترتيبهم ترتيب أبجديا.