Osteoporos Int (2006) 17: 133–142
DOI 10.1007/s00198-005-1938-9

ORIGINAL ARTICLE

Exercise maintains bone density at spine and hip EFOPS: a 3-year longitudinal study in early postmenopausal women

K. Engelke · W. Kemmler · D. Lauber · C. Beeskow
R. Pintag · W.A. Kalender

Received: 28 January 2005 / Accepted: 28 April 2005 / Published online: 12 August 2005

Abstract It is an important aim in the prevention of osteoporosis to stop or decelerate bone loss during the early postmenopausal years. Here we report on results of the 3-year EFOPS exercise trial in osteopenic women. The exercise strategy emphasized low-volume high-resistance strength training and high-impact aerobics. Forty-eight fully compliant women (55.1 ± 3.3 years) with no medication or illness affecting bone metabolism participated in the exercise group (EG); 30 women (55.5 ± 3.0 years) served as non-training controls (CG). At baseline there were no significant between-group differences with respect to physical fitness, bone mineral density, pain and nutritional status. The training consisted of two group training and two home training sessions per week. The study participants of both groups were individually supplemented with calcium and vitamin D (cholecalciferol). Bone mineral density (BMD) was measured by DXA at the lumbar spine, proximal femur and distal forearm and by QCT at the lumbar spine. Speed of sound and broadband ultrasound attenuation were determined at the calcaneus by quantitative ultrasound (QUS). Pain frequency and intensity at different skeletal sites were assessed via questionnaire. After 38 months, the following within-group changes were measured: DXA lumbar spine, EG: 0.8% n.s.; CG: −3.3% $P < 0.001$; QCT trabecular ROI, EG: 1.1% n.s; CG: −7.7% $P < 0.001$; QCT cortical ROI, EG: 5.3% $P < 0.001$; CG: −2.6% $P < 0.001$; DXA total hip: EG: −0.2% n.s; CG −1.9%, $P < 0.001$; DXA distal forearm, EG: −2.8% $P < 0.001$; CG: −3.8% $P < 0.001$; BUA, EG: −0.3% n.s; CG −5.4% $P < 0.001$; SOS, EG: 0.3% n.s; CG −1.0% $P < 0.001$. At year 3 between-group differences relative to the exercise group were: DXA lumbar spine: 4.1% $P < 0.001$; QCT trabecular ROI: 8.8% $P < 0.001$; QCT cortical ROI: 7.9% $P < 0.001$; DXA total hip: 2.1%, $P < 0.001$; DXA distal forearm: 1.0% n.s.; BUA: 5.8% $P < 0.05$; SOS: 1.3% $P < 0.001$. Pain frequency and intensity in the spine significantly decreased in the exercise group and increased in the control group, while no between-group differences were detected in the main joints. In summary, over a period of 3 years our low-volume/high-intensity exercise program was successful to maintain bone mineral density at the spine, hip and calcaneus, but not at the forearm.

Keywords Bone loss · BMD · Early menopausal women · Exercise · Osteoporosis · Resistance training

K. Engelke (✉) · W. Kemmler · C. Beeskow
R. Pintag · W.A. Kalender
Institute of Medical Physics, University of Erlangen,
Henkestrasse 91, 91054 Erlangen, Germany
E-mail: klaus.engelke@imp.uni-erlangen.de
Tel.: +49-9131-8522829
Fax: +49-9131-8522824

D. Lauber
Institute of Sport Sciences, University of Erlangen,
Erlangen, Germany

Introduction

Because of ovarian decline most women show an accelerated bone loss during early menopause [1, 2]. So far, hormone replacement therapy (HRT) has been used as a major preventive strategy, but was questioned after the publication of the WHI study [3]. As one alternative, in particular for women that according to the WHO scheme are classified as osteopenic, increased physical activity or exercise along with adequate Ca and vitamin D supplementation is often recommended to maintain bone [4]. In elderly men and women, regular exercise maintains or even increases bone mass [5, 6, 7]. However, as discussed in a recent review [8], data from studies in early postmenopausal women are less consistent (Fig. 1). Partly this is due to the inadequate control of confounding factors such as nutritional changes or diseases and medication effecting bone metabolism, partly to the small number of subjects and partly to the short study durations of often less than 12 months. Also, the exercise regimes of the studies were rather