HOW THE INCIDENCE OF STRESS FRACTURES WAS LOWERED AMONG INFANTRY RECRUITS WHILE STILL MAINTAINING BONE STRENGTHENING

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INTRODUCTION:

The goal of athletic or military training is to improve physical performance with minimum risk for musculoskeletal injury. A previous multifactor study carried out in 1983 showed that young male infantry recruits, exposed precipitously to strenuous exercise for a 14 week period, significantly increased their tibial mass density and bone mineral content [1, 2]. However, a negative outcome of this extremely intensive training was a 30.8% incidence of stress fractures. After changes in shoes and orthoses failed to lower the risk of stress fracture, two other changes in the training program were initiated. The formal cumulative marching was lowered without a decrease in the intensity of combat skills' training. Recruits were also required to sleep from 5½ to 6 hours a night except during special training. The purpose of the present study was to evaluate the effects of this new training regimen on the incidence of stress fractures, on bone strengthening and to compare the results with the 1983 study.

METHODS:

308 infantry recruits (mean age 18.96, range 18-28) signed informed consent to participate in the IRB approved study. A pre-basic training evaluation was conducted. The recruits were surveyed for the presence of known risk factors for stress fracture. Subjects' height, weight, tibia length, hip external rotation and foot arch height were measured. To track changes in bone strength, a quantitative ultrasound speed of sound (SOS) measurement was made at the mid point of the right tibial diaphysis at the medial flat tibial surface for each recruit. The SOS measurements were performed using a Sunlight Omnisense 7000 operating at a frequency of 1.25 MgHz. During the course of basic training, recruits were reviewed every 2 weeks. Those with a suspicion of metatarsal stress fractures were sent for X-rays. In cases of suspected tibial, femoral, femoral condyle or navicular fracture the recruits underwent bone scan. At the end of basic training all recruits had a final orthopaedic examination and the tibial ultrasound SOS measurement was made. The data from the current study was compared with the 1983 study.

RESULTS:

276 of the 308 recruits in the study group finished basic training. The mean age of recruits who finished basic training was 18.96 years. The stress fracture incidence in the 2003 study was reduced by 62.3 % (from 30.8% to 11.6%) in comparison to the 1983 study (Table 1). In the 2003 study, a marked shift toward lower grade stress fractures was observed (less than 9 % of the fractures were grades 3 or 4) and the femur replaced the tibia as the most frequent site of stress fracture.

In the 1983 study there was a significant increase (11.4%) in the bone mineral content after 14 weeks of basic training among recruits who did not sustain stress fractures, but not among those who sustained stress fractures (Table 2). In the current study, recruits who did not sustain stress fractures had significantly increased (0.5%) SOS values after training, while those who sustained stress fractures during basic training had a non-significant decrease (0.3%) of tibial ultrasound SOS after the training.

DISCUSSION:

By decreasing formal marching and running and enforcing a minimum sleep regimen, both the incidence and the severity of stress fractures were decreased among study participants. Combat skill training was not lowered so as to preserve fighting skills. In spite of the lowered intensity of formal marching, recruits still achieved significant gains in bone strength as measured by tibial ultrasound speed of sound. For recruits who sustained stress fractures, this benefit was lost. The off stimulus for bone building caused by rest regimens required for stress fracture healing (from three to eight weeks) apparently negated the on stimulus for bone strengthening induced by vigorous activity.

REFERENCES:


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