SAFETY AND FEASIBILITY OF OSTEOGENIC LOADING IN ADULTS WITH LOW BODY MASS: A PRELIMINARY EVALUATION

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Osteogenic Loading

In 1896, Julius Wolff, MD, hypothesized that bones increase in density when exposed to increased demand and decrease in density under less demanding conditions. This observation was later validated by animal studies and coined "Wolff's Law". In 2004, the United States Surgeon General confirmed that maximum loading of the skeletal system can increase BMD and prevent or reverse osteoporosis. Mechanical loading has been shown to both inhibit bone resorption and increase bone formation.

During osteogenic loading (OL), the user is positioned for maximal force production in the selected muscle group. The compressive force exerted is self-imposed, which allows each user to control the magnitude of the final force produced. A single OL action triggers extracellular fluid flow and transduction of mechanical signals that prompt multiple chemical and cellular responses which stimulate bone formation. DEXA scan results indicate that a multiple of body weight (MOB) greater or equal to 4, completed weekly for 36 weeks, is associated with significant BMD improvement.

4 Maximum Load Exposures

Introduction

The benefits of OL for improved bone health are documented but not previously studied in individuals with a history of low body weight in part due to concerns regarding possible bone weakness and injury risk. No study was identified that included adults with low BMI, participating in high force production exercise. Can individuals with low BMI safely participate in osteogenic loading?

Purpose

The purpose of this study was to examine if OL was: 1) safe for individuals having low BMI, and 2) to consider the potential benefits of OL for individuals with history of low BMI. This study is intended to investigate the capacity of adults with a low BMI, to safely produce compressive forces via leg press, which are of sufficient magnitude to prompt bone reformation in the femur and head of the trochanter.

Methods

The data base (N = 21,096) was drawn from a pool of adults using one model of osteogenic loading equipment from 2009-2016. The electronic database was deidentified for the purposes of this study to protect participant privacy. However, all activity for each user was electronically documented: age, gender, date of exposure, type of activity completed, and degree of force plate productivity achieved. All adults aged 18-60 years who completed a minimum of 24 OL sessions were included in this sample [n =2194]. Only individuals having lower body mass were selected (BMI 14.0-18.5), resulting in an n =260 (186 female, 74 male). 19 individuals who had a BMI of <14 were excluded from the study.

Results

Of the underweight participants (BMI 14.0-18.5) (n=260; female=186, male =74,), 95% (n=247) met or exceeded minimal forces (MOB ≥ 4). A greater percentage of underweight participants were able to achieve sufficient force for bone reformation relative to individuals of average (86.6%), overweight (79.9%), and obese BMI (52.1%). No injuries were reported.

Demographics		
Age	x = 60.2	s^2 = 5.6
Sex	744 M	1450 F
BMI 14.0-18.5 with MOB ≥ 4	74 M	186 F

Results (continued)

BMI	Total N
14-18.5	260
18.6-25	657
25.1-30	447
+30.1	830

BMI	Achieve MOB > 4
14-18.5	95.0%
18.6-25	86.6%
25.1-30	79.9%
+30.1	52.1%

Conclusions

Underweight adults had sufficient strength to safely create compressive forces associated with bone formation. OL may have restorative potential and low injury risk in an underweight population.

Results may be relevant in addressing bone health concerns among individuals with history of low body weight.

Given the serious consequences of low BMD and limited effectiveness of current remedies, it is hoped that future research will confirm OL as a safe and effective bone health care strategy for individuals at any body weight and/or history of AN.

Limitations

1. The age range was limited and additional study will be needed to understand potential benefit of OL for children, teens and more senior adults.
2. Data on history of low body weight and other health information were not available.
3. AN may affect bone health differently than low body weight due to other health, genetic and/or idiopathic factors.

References

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