A "Jump-landing" programme to improve bone health in premenopausal women.

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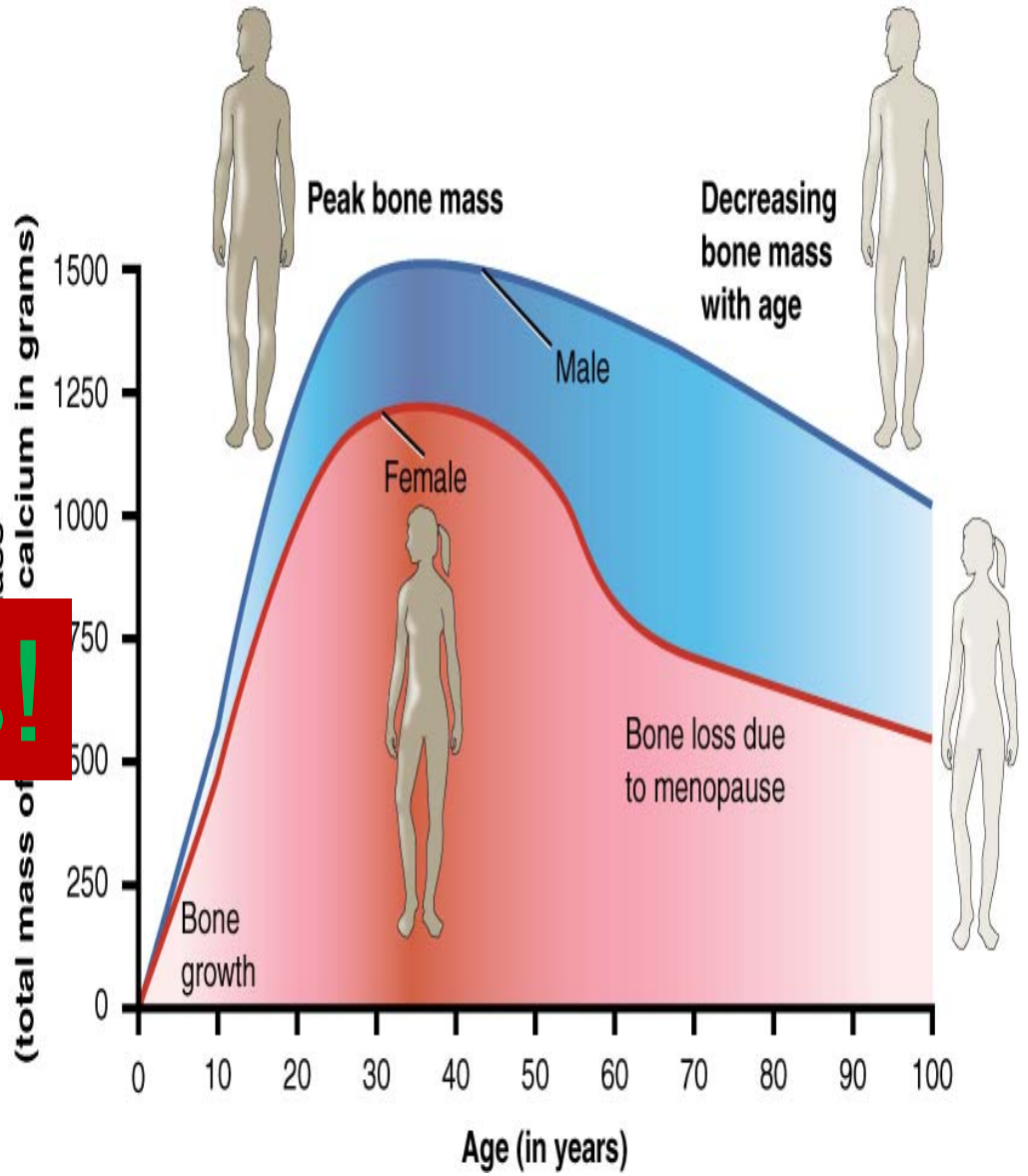
Rationale & significance of this study

- Normal bone losses
  (post 'peak bone mass')
  = 0.5% BMD/year.
- Menopausal losses
  = 1-2% BMD/year.
- Lose up to **20% BMD**

Prevention focus!

Target: Premenopausal women.

Window of Opportunity!



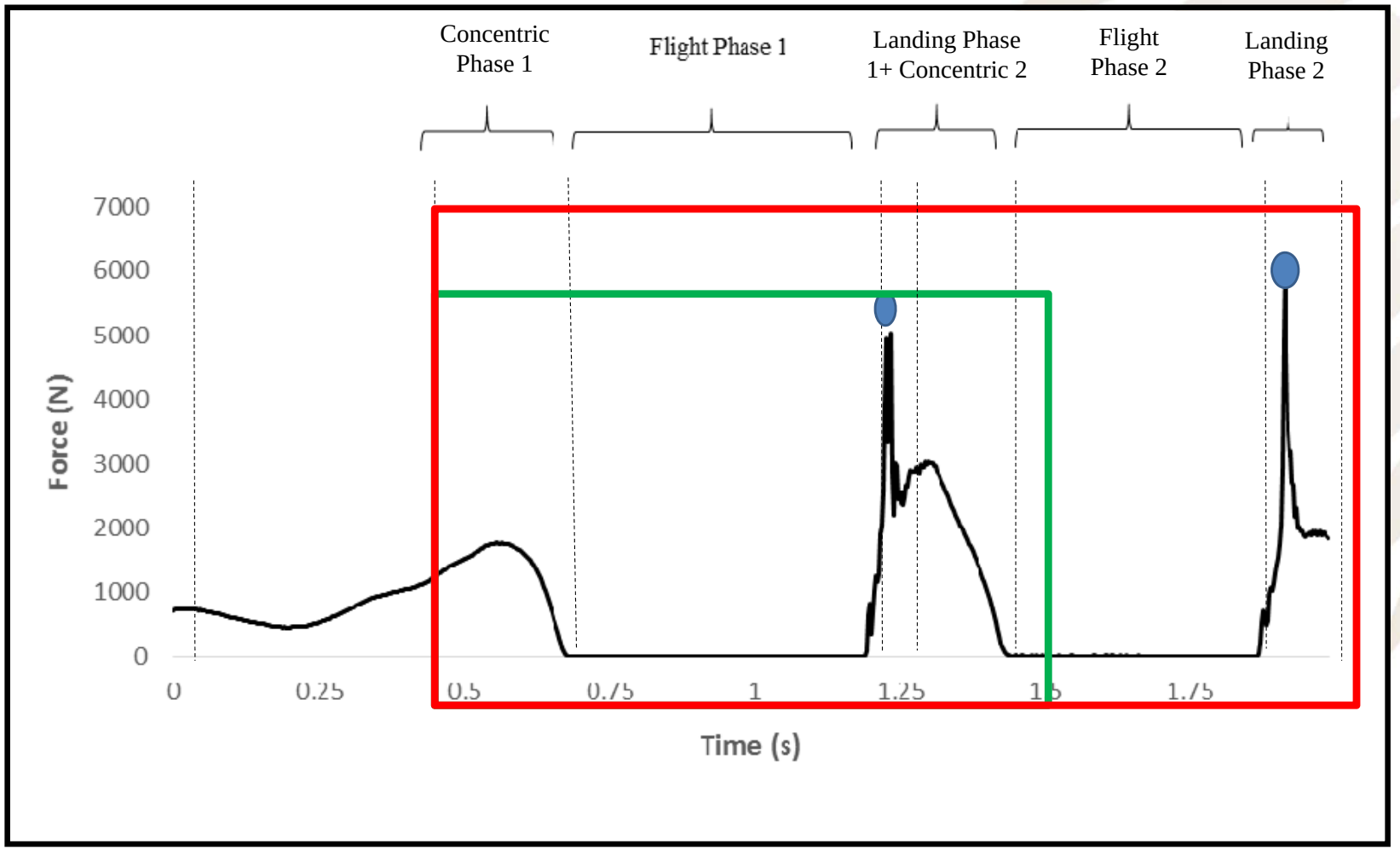
https://commons.wikimedia.org/wiki/File:615_Age_and_Bone_Mass.jpg

The Mechanostat Theory

Wolffs Law; "bone adapts to mechanical loads"

1. **Mechanical forces** exceeding a 'remodelling threshold' will stimulate bone formation and ↑ **bone mass & strength.**
2. **3-5% gains in BMD** during premeno years with **appropriate exercise** (Babatunde et al., 2012).
3. **Current recommendations are outdated** (Ebling et al., 2013, Howe et al., 2011, Martyn-St James & Carroll, 2008 &2009, Zhao, Zhao & Zhang, 2014 & Beck et al., 2017).

Vertical Force Profile of CMVJ +RJ



CMVJ

CMVJ+RJ

Figure 3: A vertical force profile of the CMVJ +RJ. Dashed lines represent the phases depicted in Figure 2. Circles indicate peak landing forces for landing 1 and 2, respectively.

Countermovement Jump (CMVJ+RJ)

Figure 2: Pictorial representation of the phases of the CMVJ+RJ as described in this study: A) Start of the eccentric phase; B) Start of the concentric phase; C) Last ground contact before flight phase 1; D) Peak jump height 1; E) First impact for landing phase 1; F) Last eccentric landing phase 1; G) Last ground contact before flight phase 2; H) Peak jump height 2; I) First impact for landing phase 2; J) Last eccentric landing phase 2.

The effects of a quantified jump-landing programme on bone health in premenopausal women.

Aims:

- **To determine the effects of a quantified jump-landing programme intervention on parameters of bone health for premenopausal women.**
  - To measure bone mineral density (BMD) and bone geometry (utilising specialised hip structural analysis HAS, and Trabecular Bone Score TBS,software).
  - To determine the time course of bone response for factors which contribute to overall bone strength and fracture resistance.

Study 5: The chronic effects of a quantified jump-landing programme on bone health in PM women.

Subjects:

80 healthy premenopausal women (30 - 50 years)

Methodology:

A cluster randomised controlled experimental design (12 mth)

Testing (0, 3, 6, 9 and 12 mth):

Ht, Wt,Vert. jump, Balance (AMTI Forceplate), Reactive strength (Contact mat), 3-day food diary/ Foodworks, DEXA: BMD (L. Femur and Lumbar (L1-L4), body comp.

Familiarisation:

Randomised into jump or control group.

All jumps demo and practiced.

Programme:

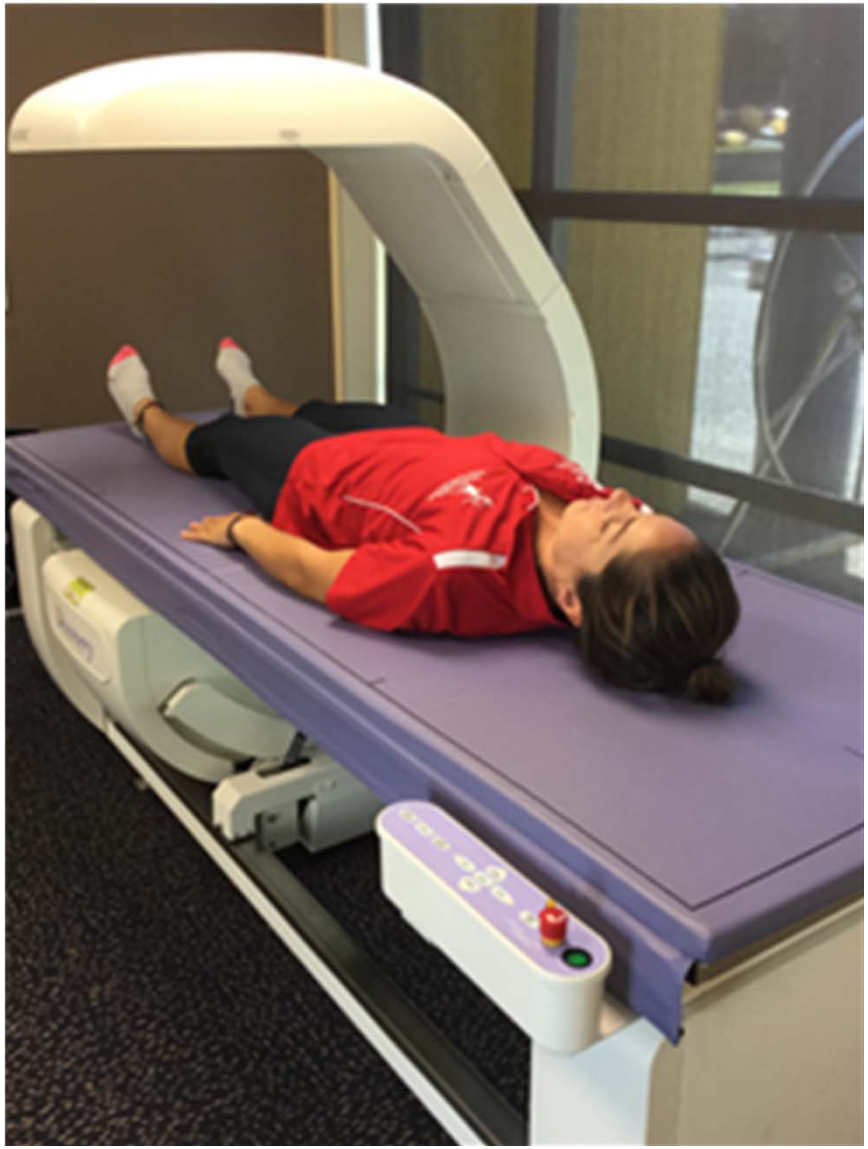
12 Month Jump-landing prog. developed.

Group classes (incl. 4-week intro programme).

Website (Jump-tracker, Videos)

Facebook, eTXT.

DEXA at Toi Ohomai Institute of Technology



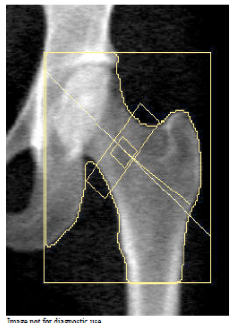


Image not for diagnostic use
96 x 112
NECK: 49 x 15

Scan Information:

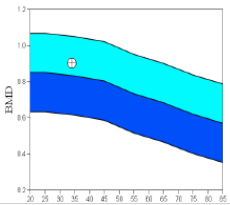
Scan Date: 20 November 2017 ID: A1120170S
Scan Type: f Left Hip
Analysis: 20 November 2017 11:56 Version 13.6.0.3
Hip
Operator:
Model: Discovery A (S/N 85816)
Comment:

DXA Results Summary:

Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	Z - score
Neck	5.32	4.80	0.902		0.6
Troch	12.21	9.48	0.777		0.7
Inter	18.40	22.53	1.224		0.8
Total	35.93	36.80	1.024		0.7
Ward's	1.30	1.15	0.885		1.6

Total BMD CV 1.0%

Neck



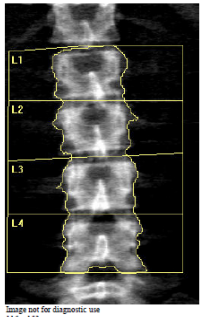
FRAX® WHO Fracture Risk Assessment Tool

10-year Fracture Risk¹

Major Osteoporotic Fracture	1.7%
Hip Fracture	< 0.1%

Reported Risk Factors:
US (Caucasian), Neck BMD=0.902, BMI=25.0
Input outside FRAX® limits. Adjusted to:Age=40

¹ FRAX® Version 3.05. Fracture probability calculated for an untreated patient. Fracture probability may be lower if the patient has received treatment.



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Scan Information:

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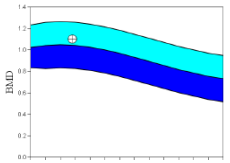
Scan Type: f Lumbar Spine
Analysis: 20 November 2017 11:52 Version 13.6.0.3
Spine
Operator:
Model: Discovery A (S/N 85816)
Comment:

DXA Results Summary:

Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	Z - score
L1	16.23	16.40	1.010		0.2
L2	17.57	19.45	1.107		0.8
L3	17.83	21.18	1.188		1.0
L4	19.36	21.18	1.094		0.3
Total	71.00	78.20	1.101		0.5

Total BMD CV 1.0%

Total



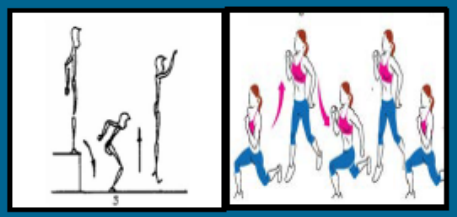
Comment:

Jump Programme

1

What jumps are we doing for the next 4 weeks?

The Drop Jump + Stride Jump



2

How many times do we perform the programme each week?

4-5X

3

How many jumps do we do each session?

8 Drop+8 Stride jumps

(this means 32 jump-landings)

4

How do we perform the jumps?

Perform 4 MAXIMAL jumps at a time (1 set), and perform 2 sets of each jump in the session.

* see the 4-week programme for details

5

How much rest do we have?

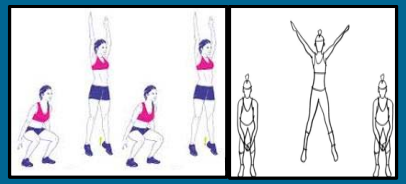
Take a couple of seconds between each jump, and around 30 seconds between each set.

Jump Programme

1

What jumps are we doing for the next 4 weeks?

The Countermovement jump + Star Jump



2

How many times do we perform the programme each week?

4X

3

How many jumps do we do each session?

8 CMJ + 8 Star jumps

(this means 32 jump-landings)

* Countermovement jump = CMJ

4

How do we perform the jumps?

Perform 4 MAXIMAL jumps at a time (1 set), and perform 2 sets of each jump in the session.

* see the 4-week programme for details

5

How much rest do we have?

Take a couple of seconds between each jump, and around 30 seconds between each set.

https://sites.google.com/g.toiohomai.ac.nz/bonestudy/the-jump-landing-programme

Preliminary Results: Jumping group (at 6mth)

- Substantial body comp. changes
  (body fat ↓ 2.4kg; FFM ↑ 1.4kg)
- BMC & BMD in femoral sites (↑ **2-3.5%**)
- BMC & BMD in lumbar sites (↑ **1.8-2.9%**)
- Cortical thickness at femoral neck & shaft
  (↑ **3.4-5%**)
- CSA at femoral neck & shaft
  (↑ **1.8-3.1%**)