Effects on function, bone mineral density and lean tissue mass 12 months following total knee replacement in a female post-menopausal population

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INTRODUCTION

Disuse osteopenia is a known consequence of reduced weight-bearing on lower limbs. Knee Osteoarthritis (OA) commonly necessitates joint replacement with limited mobility for a variable period post-surgery. Although OA is associated with higher levels of BMD, a significant increase in hip fracture incidence in the year following total knee replacement (TKR) has been demonstrated [1]. This study investigated the extent of disuse-related bone loss at the hip following TKR and its potential contribution to post-surgical fracture risk.

METHOD

DXA measurements (GE Lunar Prodigy) were taken of BMD at the neck of femur (NOF) and total hip (TH), and leg lean tissue mass (LLTM) in a sample of 19 post-menopausal female TKR patients compared to 43 controls. Ipsilateral/contralateral weight-bearing, lower-limb function, 3-day pedometer readings and falls were recorded. Data were collected at pre-surgery baseline (except pedometer readings taken immediately following TKR), and at six weeks, six months and twelve months post-surgery. Data were not collected at the six week interval for the controls.

RESULTS

Table I. Participant characteristics at baseline

	Controls	TKR
	Mean (SD)	Mean (SD)
n	43	19
Age (y)	64.7 (7.7)	66.1 (6.9)
Weight (Kg)	68.3 (10.2)	83.1 (16.1)†
Height (m)	1.6 (0.1)	1.6 (0.1)
BMI (kg/m²)	25.4 (3.2)	32.2 (7.1)†

† Difference between groups significant P<0.01

Figure1. Changes in BMD at Ipsilateral Total Hip and Neck of Femur

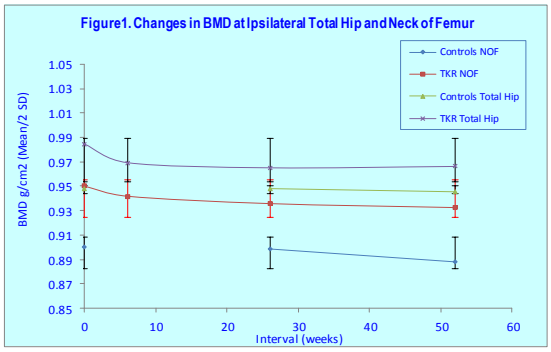


Figure 2. Changes in BMD at Contralateral Total Hip and Neck of Femur

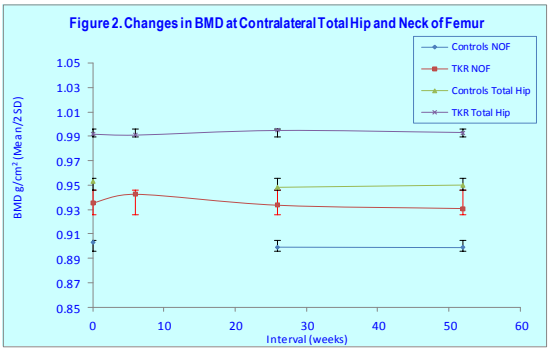


Table II. Results

	Controls			TKR		
	Mean (SD)			Mean (SD)		
	Baseline	6 months	12 months	Baseline	6 months	12 months
% Ipsilateral weight-bearing	50.2 (4.4)	50.5 (4.9)	49.6 (4.6)	43.5 (9.9)†	48.5 (5.6)*	48.5 (5.7)*
LEFS‡ (maximum score 80)	74.0 (8.6)	73.0 (9.7)	72.0 (11.0)	31.0 (15.4)†	48.0 (17.7)*†	50.0 (15.7)*†
Pedometer reading (steps per day)	9717 (3596)	8103 (3415)*	8626 (3329)*	870 (1283)†	4361 (3046)*†	4408 (1997)*†
Mean Number of falls in previous 6 months	0.19 (0.40)	0.23 (0.61)	0.09 (0.29)	0.37 (0.90)	0.47 (1.02)	1.37 (3.50)

* p=<0.05 when compared to baseline for the same group

† Difference between groups significant P<0.01

‡ *Lower Extremity Functional Scale, Binkley et al*

Figure 3. Changes in Ipsilateral Leg Lean Tissue Mass

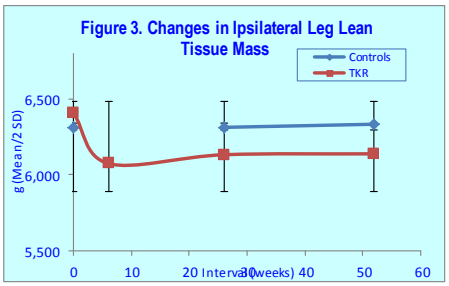
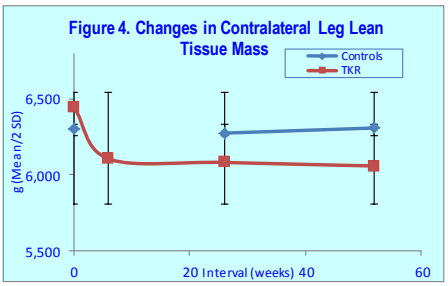


Figure 4. Changes in Contralateral Leg Lean Tissue Mass



Error bars represent 2 Standard deviations (SD)

DISCUSSION AND CONCLUSION

Despite showing improvement in most areas of function and activity, recovery following TKR was slow and incomplete one year after surgery. The effects of immobilization following TKR were an immediate and statistically significant loss (p=<0.05) of ipsilateral bone mass at the total hip and at the NOF (after 6 months) Fig.1., accompanied by significant (p=<0.05) bilateral muscle atrophy (Figs.3 & 4) that continued gradually over the following 6 months and remained one year after surgery. The clinical significance of these reductions in hip BMD are an increased risk of hip fracture that may be exacerbated by muscle loss which could affect patients' gait and postural stability thereby increasing the risk of falls.

FUTURE WORK

Further work to investigate longer-term recovery in function, activity and measures of BMD and LLTM are required to ascertain how long deficits persist following TKR.
High BMD values in this group may not reflect bone quality and further study to evaluate the fragility of osteoarthritic bone is needed.

REFERENCES

1. Prieto-Alhambra, D., et al., *Changes in hip fracture rate before and after total knee replacement due to osteoarthritis: a population-based cohort study.* Annals of the Rheumatic Diseases, 2011. **70**(1): p. 134-138.

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