PERFORMANCE OF A NEW CANCELLOUS BONE EXPLANTS TISSUE CULTURE-LOADING SYSTEM

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INTRODUCTION: A new apparatus "ZETOS" that allows cultivating adult cancellous bone explants under controlled culture and loading environment is tested. Suitable culture conditions over a three week period were determined and the effects of a loading regimen were analyzed.

METHODS Bovine cylindrical (10mm diameter) bone biopsies from 3 sternums were precisely machined with a diamond trephine from 1cm thick bone slices, then strictly plan parallel surfaces were cut in order to obtain 5mm height disks (±1µm). These samples fitted in chambers of similar dimensions and were provided with culture medium (DMEM, 10% FCS, ascorbic acid 10^{-8} M). We determined an optimal medium flow rate from the peristaltic pump at 6ml/h which ensured a uniform diffusion within the bone sample and fluorochrome labellings. Nine samples were immediately processed for histomorphometry and were used as basal control (B Ctr). Twenty six were maintained in culture over 3 weeks, 14 were loaded (L) at 4000µS, 1Hz, 300 cycles per day and 12 were unloaded (U).

RESULTS: Bone mass and Young Modulus (E) were similar in B Ctr, L and U. Trabecular thickness was higher in L and U compared to B Ctr (20%). Bone formation parameters (osteoid parameters, mineral apposition rate and bone formation rate) were increased in L versus U (by 48, 30, 48%, respectively).

Table 1. Bone histologic parameters.

Group	BV/TV (%)	Tb.N (mm-1)	Tb.Th (µm)	Os/BS (%)	MAR (µm/day)	BFR/BS (µm2/µm3/day)
B Ctr.	13.4±3.43	2.51±0.38	67.95±16.85	8.61±1.65		
L	14.44±2.3	2.26±0.30	80.18±13.42	14.38±2.98	0.93±0.17	1.17±0.46
U	13.31±2.10	1.68±0.23	79.49±8.12	9.72±3.67	0.7±0.17	0.79±0.31

DISCUSSION & CONCLUSIONS: In conclusion, a 3-week culture period did not alter mechanical properties and osteoblastic cell reactivity. This model proved to be sensitive to loading conditions. The exercise-induced osteoblastic stimulation might lead to structural adaptation after longer experiments.

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