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DEVELOPMENT OF A THREE-DIMENSIONAL *IN VITRO* MODEL SYSTEM TO STUDY ORTHODONTIC TOOTH MOVEMENT

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Few three-dimensional (3D) models exist to study cell and molecular regulation of orthodontic tooth movement (OTM). The aim of this work was to develop a 3D *in vitro* model to study mechanical loading of human periodontal ligament fibroblasts (hPDLF).

Methods: hPDLFs were seeded into fibrillar collagen gels constrained in culture wells. The viability, proliferation, and function of the hPDLFs were characterized over 14 days. hPDLF-seeded collagen gels were then cast in a device with movable end plates and subjected to static tensile, compressive, or no loading conditions. Cells were characterized within the model and the strain distribution was assessed.

Results: Within the well-based cultures, cell viability was uniform throughout the gel. The number of cells increased five-fold by D7 ($p<0.05$) and remained similar until D14. Collagen fibre alignment and the degree of contraction of released gels was highest in the D7 and D14 gels ($p<0.05$). In the 3D model, viability was greatest in hPDLFs subjected to tension ($p<0.05$). Finite element modelling of the 3D model predicted strain magnitudes of approximately 12% in both the compression and the tension cases.

Conclusions: The collagen gel supports hPDLF proliferation, viability, and the emergence of a contractile phenotype, replicating the constrained condition of the human PDL in vivo. The 3D model mimicked PDL strains similar to those observed during OTM, and can be used for future studies to better understand the effects of OTM on PDL fibroblasts.

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CONE BEAM CT STUDY OF RELATIONSHIP BETWEEN FACE HEIGHT AND DENTOALVEOLAR POSITION.

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Background: The intraoral findings of patients presenting with differing lower anterior face heights are variable. Cephalometric and model studies on the subject have elicited contradictory results. By analyzing the pre-treatment cone beam computed tomography (CBCT) records of orthodontic patients, it is possible to assess dental and skeletal features of interest that are relevant to orthodontic treatment planning.

Objective: To determine differences between the dentoalveolar positions of maxillary and mandibular central incisors and first molars in subjects classified into three groups: long, normal and short lower anterior face height.

Methods: Upper anterior face height/lower anterior face height ratios (UAFH/LAFH) were determined from 111 pretreatment iCAT® (Imaging Sciences International, Pennsylvania) CBCT scans and analyzed with AMIRA® (Mercury Computer Systems, Germany) imaging software. Upper and lower central incisor and first molar vertical heights and buccolingual inclinations were measured relative to fixed reference planes. Mean differences in tooth heights and inclinations between the groups were assessed using an analysis of variance.

Results: Clinically significant differences in dentoalveolar heights, but not buccolingual inclinations, between the three face height groups were found.

Conclusions: Face height and dentoalveolar position can be determined using cbCT image data. Vertical height, not buccolingual inclination, contributes to differences in lower anterior face height.

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