Conclusion: It is therefore suggested that pressure effects due to gravity acting differently on different parts of the scalp and thus obliterating blood supply in scalp regions, may be a premier reason for the particular pattern of balding seen in male pattern alopecia.

OP7.202

Rib morphology

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Introduction: Human ribs are angulated. There are changes in rib angulation that occur with body growth. Rib angulation was correlated with the vectors of chest wall forces estimated by an ellipsoid biomechanical model using finite element analysis.

Aim: To measure changes in rib angulation that occur with body growth; to calculate the direction and magnitude of chest wall forces in an ellipsoid biomechanical model using finite element analysis techniques and to correlate the vector of the forces acting on the ribs with rib morphology.

Methodology: Rib dimensions and angulation were measured using thoracic CT scans from foetal, paediatric, adolescent and adult humans. Chest wall forces were modelled with an ellipsoid finite element analysis model. Comparisons were made between rib angulation and direction of chest wall forces, and between rib height and intercostal muscle force measured as the force vector perpendicular to the rib.

Results: There was a statistically significant correlation between rib angulation measured at the mid-axillary line and the direction of the vector of the resultant chest wall forces acting on ribs (p=0.03). Rib height was significantly correlated to intercostal muscle force (p<0.001), with both these parameters increasing with progressive rib number as one descends the chest wall (p=0.004 and p<0.001 respectively).

Conclusions: In adults, ribs are angulated at the mid-axillary line such that chest wall forces run along their length. There was a statistically significant correlation between rib height and calculated intercostal muscle force. In the foetus, ribs are horizontal and have equal height. There was a progressive increase in rib angulation with age, particularly in early childhood between 3-5 years age, as rib angulation changes to the direction of the resultant chest wall forces.With age, rib height is also progressively 'stretched' in response to the increasing intercostal muscle force with increasing rib number. The increasing rib height with increasing rib number in adults is related to the increasing calculated intercostal muscle force.

OP7.203

Load bearing shell structures and rib cortical thickness

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Introduction: Variations in rib cortical thickness data are analysed by assessing the chest wall as a load bearing shell structure.

Aim: To assess the response by changes in thickness of rib cortical thickness to estimated rib load since bone remodels and adapts itself to loading (Wolff's law).

Methodology: A mathematical analysis of a simplified chest wall shape was used. Finite element analysis of the chest wall was also used to model chest wall forces. Measurements of rib cortical thickness were taken from cross sectional geometry studies of 5 human rib cages.

Results: Chest wall stress is proportional to the radius of the chest wall with a higher level of stress (p=0.001) present in the lower chest wall as compared to the apex. There was a calculated approximately 5x difference in bone stress between the internal and external rib surfaces (p<0.001). Ribs respond to stress by a 29% external and a 55% internal cortical increased thickness and a 13% height increase and 23% width increase between the third and seventh rib levels before diminishing slightly to the ninth rib level as the rib cage radius diminishes at the waist. The thickness of the inferior and superior cortices remained the same.

Conclusion: The pattern of rib cortical thickness can be predicted by mathematical modelling of load bearing shell structures, with internal and external rib cortices and rib size following Wolff's law due to a predicted approximately 5x increase in bone stress between the internal and external rib surfaces and a 30% increase between apex and base.

OP7.204

Heat shock modulators protecting normal cells during chemotherapy

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Introduction: Heat shock proteins (HSPs), are a family of molecular chaperones, highly conserved amongst living organisms through evolution. They interact with proteins to aid in their correct folding, reverse the process of denaturation, and also deviate from the apoptotic pathway. Tumour cells are known to have high basal expression of HSPs, but a lower inducible expression of HSPs when compared to normal cells. Tex-OE® is a nutraceutical known for its reparative function on stressed cells via an HSP70-directed pathway. The negative effects of chemotherapy on patients are attributed to the deleterious effects of the cytotoxic drugs on normal cells, including myelosuppression. Considering the reparative function of Tex-OE® and the HSP inducibility variation between normal cells and tumour cells, it may be possible to confer the protective effect of the Tex-OE®-induced HSP70 to the bone marrow during chemotherapy, thus reducing the myelosuppressive effect of the chemotherapy.

Aim: To study the cytoprotection instilled by TEX-OE® on normal cells and cancer cells when exposed to chemotherapy

Methodology: Cancer cell lines and progenitor cells (obtained from cord blood) were treated with Tex-OE® and chemotherapy (cisplatin, cytarabine, doxorubicin, methotrexate or vincristine), sometimes using heat shock as an added stress. MTT and XTT assays were used to read the cytotoxic effects of these treatments while HSP70 ELISA was used to measure variations in HSP70 concentrations.

Results: Tex-OE® did not increase the HSP70 concentration in 3 cancer cell lines. Moreover, Tex-OE® used in combination with cisplatin and vincristine resulted in increased sensitivity of the cells towards the individual chemotherapies. There was increased sensitivity to vincristine in HL-60 and also in HCT-116, and to cisplatin in all cell lines. Tex-OE® also conferred a protective effect to progenitor cells obtained from cord blood.

Conclusion: From our results, Tex-OE® has shown promise as a cytoprotective agent that could protect the progenitor cell population and bone marrow when used in conjunction with chemotherapy.