A 3D CT ANALYSIS OF MALAY CLEFT LIP AND PALATE INFANTS

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DECLARATION

I declare that this thesis contains no material which has been accepted for the award of any other degree or diploma in any University and that, to the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except where due reference is made in the text.

I give consent to this copy of my thesis being made available for photocopy and loan from the University of Adelaide Library.

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SUMMARY

This thesis describes the three-dimensional (3D) assessment of craniofacial structures in cleft lip and palate patients pre-operatively. The study subjects were 29 cleft lip and palate (CLP) infants of Malay origin aged between 0-12 months and 12 non-cleft (NC) infants matched for age. CT scans were obtained using a GE Lightspeed Plus Scanner. The cranio-cervical facial morphology of cleft lip and palate has been analysed using computer programs based on cephalometric landmark points in three-dimensions.

Analysis of selected craniofacial and cervical regions has included:

- Measurement of the position of the hyoid bone in relation to the cervical vertebrae and cranial base
- Measurement of the length of the cervical spine and intervertebral spaces
- Measurement of the nasopharyngeal complex
- Measurement of the cranial base
- Measurement of the width of spheno-occipital synchondrosis.

These findings have also been associated with related clinical problems, such as aspiration pneumonia.

A statistical comparison of individual cranio-cervical facial bones of cleft lip and palate infants with age-matched adjusted for the effect of sex non-cleft infants revealed areas of significant variation from normal. Very few of the study variables displayed significant differences between males and females in either the CLP or NC

group. From the analyses of these areas, findings are documented and compared to those previously reported in the literature. Furthermore, previously unreported findings have been highlighted.

The anomalies noted include a lower position of the hyoid bone, located at the level of C3 or C4 in the cleft lip and palate infants, whereas in the non-cleft infants, it was positioned at the much higher level of C2 or C3. In addition, 5 patients in the cleft group had significant hyoid bone abnormalities such as absent body, greater horn or overall abnormal shape. These results could be associated with compromised function of the epiglottis in forming a seal with the larynx, thereby increasing the risk of aspiration pneumonia.

The findings of the cervical spine include the significantly smaller height of the vertebral bodies with larger intervertebral spaces in the cleft lip and palate infants compared with the non-cleft infants and fusion of the posterior arch of the cervical spine.

The results also showed an increased pharyngeal width in the cleft lip and palate infants compared with the non-cleft infants. These anatomical variations may be associated with disruptions in the dilatory mechanism of the eustachian tube thus leading to recurrent middle ear infection in the cleft children and subsequent loss of hearing.

Analysis of data on the cranial base showed a smaller cranial base that could be associated with the observed midface hypoplasia in cleft lip and palate infants that occurs with growth in these infants. Infants with cleft lip and palate had a wider spheno-occipital synchondrosis, in contrast to the narrower spheno-occipital synchondrosis reported previously with Crouzon syndrome and Apert syndrome. A

wider spheno-occipital synchondrosis could be associated with dysmorphic and compensatory growth changes in later life.

The observed morphological aberrations in early childhood reflect abnormalities that have developed in embryonic/foetal life. Interestingly, the isolated cleft palate group showed different results for several study variables from the other affected groups and this is consistent with its distinct aetiology.

The detailed analysis of the severity and extent of the deformities provided insight into the biological basis of cleft lip and palate. The investigation has highlighted the existence of a greater range of extracranial anomalies in cleft lip and palate than previously thought and should assist clinicians in the management of affected infants. The findings should also be of interest to craniofacial developmental biologists who are investigating the complex biological processes of human development. Furthermore, the thesis provides support for the concept that cleft lip and palate is part of a broader craniofacial anomaly, not just a localised defect.