The Application of 3D Images for Quantitative Determination of Zygoma in an Asian Population

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Nothing to Disclose
introduction

commonly fracture of zygoma
zygomatic complex is the most prominent and most commonly fracture in midface

postoperative asymmetry
asymmetry and poor aesthetic outcomes in 10% of patients

insufficient if realign bones only
both skeletal and soft tissue affects outcomes

tools for more accuracy
is there anthropometric methods for quantitative evaluation?
**Cephalometry**

It is convenient and fast, but

- **overlapped structure**
- **measurement errors from positioning**

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**Quantitative topographical evaluation**

It is accurate in soft tissue, but

- **time consuming**
- **inconvenient to repeat**
- **poor evaluation of bone**

Czerwinski, 2005
3D digital photogrammetry system
It is accurate in soft tissue, but
• image distortion
• poor evaluation of bone
• costly

Traditional CT
It is accurate in bone tissue, but
• measurement errors from positioning

Lane, 2008
insufficient tools

none of the methods is able to measure both soft and hard tissues simultaneously.

CT 3D images

• Increase in resolution of CT images
• Widely applications of 3D images

computer-assisted system

• Amira®
our aims

idealization of anthropometry

- fast and accurate
- regardless of position at image acquisition
- measure both bone and soft tissues simultaneously

3D CT images processed by Amira®

- determine the reference points and distance values
- examine the accuracy and repeatability
- determine symmetry from bilateral values
20 Taiwanese adults randomly selected underwent craniofacial CT
- 10 male
- 10 female

**Inclusion criteria**
- bilateral zygoma intact
- no zygomatic injuries
- trauma surveys negative

**Exclusion criteria**
- congenital anomalies of face
- injuries of zygoma
- prior surgical history
protocols

CT Acquisition at initial presentation (ER)

Frankfort horizontal position by Amira®

CT data (DICOM) to STL files by Amira®

Measurement of references distances

American Society of Plastic Surgeons @ Chicago, 2014
Nasion (n)
point in midline of nasal root and nasofrontal suture

Orbitale (or)
lowest point on inferior orbital rim

Vertex (v)
highest point of head at FH position

Zygion (zy)
most lateral point on zygomatic arch

Maxillozygion (mz)
most prominent point on frontal aspect of face, below bony orbit

Opisthocranio n (op)
most posterior point of head at FH position
results of measurements

Bone tissues

Soft Tissues

no significant difference bilaterally\(^*\) (\(P < 0.05\))
### results of measurements

<table>
<thead>
<tr>
<th></th>
<th>inter-subject variability (SD1)</th>
<th>inter-measurement variability (SD2)</th>
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</thead>
<tbody>
<tr>
<td>Bone</td>
<td>3.1-9.2 mm</td>
<td>0.7-1.6 mm</td>
</tr>
<tr>
<td>Soft Tissue</td>
<td>1.8-9.3 mm</td>
<td>0.1-1.8 mm</td>
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**inter-subject**
- relatively small compared to the mean
- relatively constant position of zygoma in skull

**inter-measurement**
- SD2 < 2 mm
- clinical insignificant for repetitive errors
- unable to detect in experience surgeons
Positioning

- mis-positioning leads to errors
- no adjustment required before CT images acquisition
- proper positioning by Amira®

Symmetry

- no significant difference between both sides (P < 0.05)
- allowing comparison for establishing symmetry with unilateral lesion
conclusion

3D facial CT with Amira®
Time-saving, accurate, consistent

asymmetrical determination
determining degree of asymmetry by quantitative comparison of ipsilateral side

measurement of skeletal and soft tissue
both tissue can be assessed separately and accurately

tool for comparison
accurately determine the surgical outcomes among different techniques on zygoma
future works

**restore symmetry**
mirroring the contralateral side of zygomatic complex
assisting symmetry intraoperatively

**reference database**
more data as a reference database for quantitative evaluation

**dynamic relation**
evaluate the dynamic state between skeletal and soft tissues for better post-operative estimation

**navigation**
guide of intraoperative navigation