Recording Cranial and Postcranial Measurements in Osteoware

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Introduction
When documenting skeletal remains, metric data can be useful for a variety of purposes, including estimating sex, ancestry, stature, and age, using software such as Fordisc (Jantz and Ousley 2005). Ideally, the measurements follow established standards to allow the greatest number of comparisons to previously published measurements. Osteoware provides an interface to enter cranial and postcranial measurements (Figures 1,2,3).

The 34 cranial measurements in the Standards (Buikstra and Ubelaker 1994) follow those of the Forensic Data Bank (FDB; Moore-Jansen et al. 1994), which are predominantly based on Martin’s classic definitions. In Osteoware, the cranial measurements follow the Howells (1973) definitions for 60 measurements that include nearly all of the FDB cranial measurements as well as subtenses, fractions, and radii. These measurements are stored in fields using Howells’ three-letter designations for craniometrics. Mandibular measurements are those included in the Standards. Two additional measurements not collected by Howells, minimum frontal breadth and palate length (designated as WFB and MAL) are also collected.

The craniometric file format used is the same as that used by Threeskull software (Ousley 2010; Figure 4), which expedites the collection of three-dimensional coordinate landmark data (Figures 5 and 6) using a digitizer (Figure 7) and calculates craniometrics.

The craniofacial entry screen is similar to that used in Threeskull. Using all 18 measurements (Table 1), the cranium was most similar to Dogon (West African) females with a posterior probability (pp) of 0.710 and typicality probability (tp) of 0.980 (Table 2). In fact, the three closest groups using all measurements are African or African-derived. This kind of result brings the ancestry (Native American) into question. After eliminating nine measurements most affected by midfacial hypoplasia, it was most similar to Santa Cruz females (pp = 0.319; tp = 0.980).

The features associated with underdevelopment of the midface observed in this skeleton are consistent with Binder syndrome, a maxillofacial dysplasia. Mulhern (2002) compared cranial measurements from this skull to published clinical data for Binder syndrome patients and normal control groups. Mulhern’s results provided strong support that Binder’s syndrome is the appropriate diagnosis for the unusual features observed in this skull. Craniofacial measure are very useful for estimating ancestry, but the naïve classification of skulls affected by pathological conditions or syndromes can be quite misleading.

Field names in Osteoware follow the naming system established by Howells and subsequently modified by Mulhern (1994). There are three types of measurements: simple, derived, and transformed. Simple measurements are to be recorded directly from the specimen. Derived measurements are functions of two or more simple measurements. Transformed measurements are the result of applying a function (e.g., logarithm, square root) to one or more derived measurements.

Field names are in the format s<name>, d<name>, t<name>, or x<name>, where s, d, t, and x denote simple, derived, transformed, and invalid, respectively. Field names are defined in a separate file; the numbers following the letter give the order in which the fields are listed.

Table 1. Measurements used in full analyses. The left column shows the reduced set of nine.

<table>
<thead>
<tr>
<th>Group</th>
<th>Analysis 1</th>
<th></th>
<th></th>
<th>Analysis 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Closest</td>
<td>2nd closest</td>
<td>3rd closest</td>
<td>Closest</td>
<td>2nd closest</td>
<td>3rd closest</td>
</tr>
<tr>
<td>Group</td>
<td>Dogon</td>
<td>Andaman Id</td>
<td>Teita</td>
<td>Santa Cruz</td>
<td>Hainan</td>
<td>Dogon</td>
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<tr>
<td>pp</td>
<td>0.710</td>
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<td>0.051</td>
<td>0.319</td>
<td>0.185</td>
<td>0.088</td>
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<tr>
<td>tp</td>
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<td>0.032</td>
<td>0.026</td>
<td>0.980</td>
<td>0.941</td>
<td>0.891</td>
</tr>
</tbody>
</table>

Table 2. Results of discriminant function analysis. pp: posterior probability; tp: typicality probability.

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References