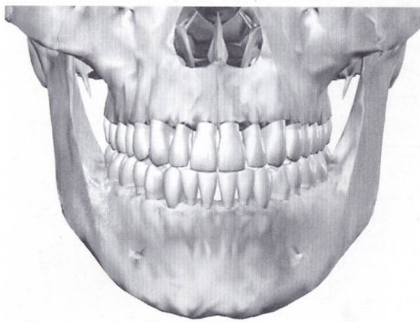# Digital Laser Scans Used in Morphometric Analysis of Human Skulls To Demonstrate Dental Occlusal Function II

By Ronald G. Presswood, D.D.S. and Ronald G. Presswood, Jr., P.E., Houston

Presswood

Protocol

Skulls used in the study were photographed at a fixed focal length using a Sony Mavica MVC-CG1000 digital camera (Figure 1) and then digitally scanned using a Minolta Vivid 3-D laser scanner (Figure 2). The scans were imported into a Dual Processor Dell workstation and assembled into
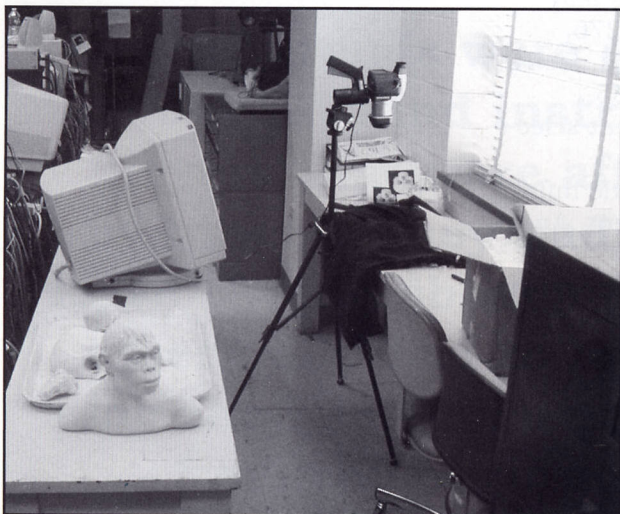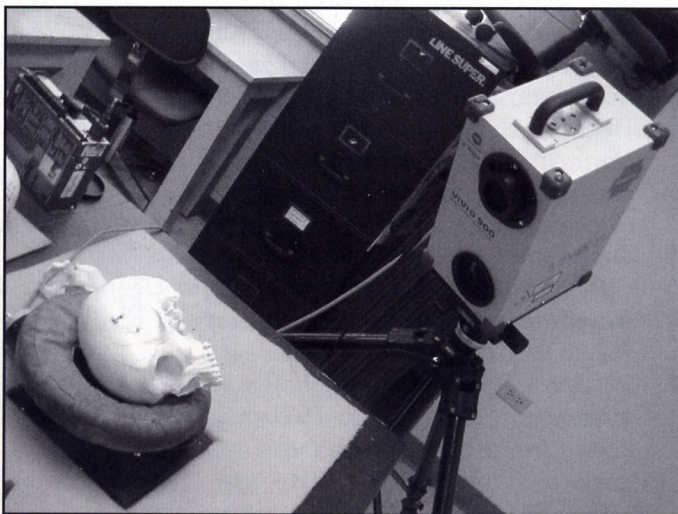

Figure 1.

Figure 2.

manipulatable 3-D images using INUS Technology, Inc., RapidForm software (Figure 3).

Specific areas of interest (based on the supposition) on the scanned surfaces were selected for analysis (Figures 4 and 5). The areas identified had been previously marked in dynamic function using an inked red silk ribbon. The specific areas of interest were the medial wall of the glenoid fossa on the moving or gliding side, a posterior tooth contact on that side (ipsilateral) and an anterior tooth on the opposite side (contralateral) (Figure 6).

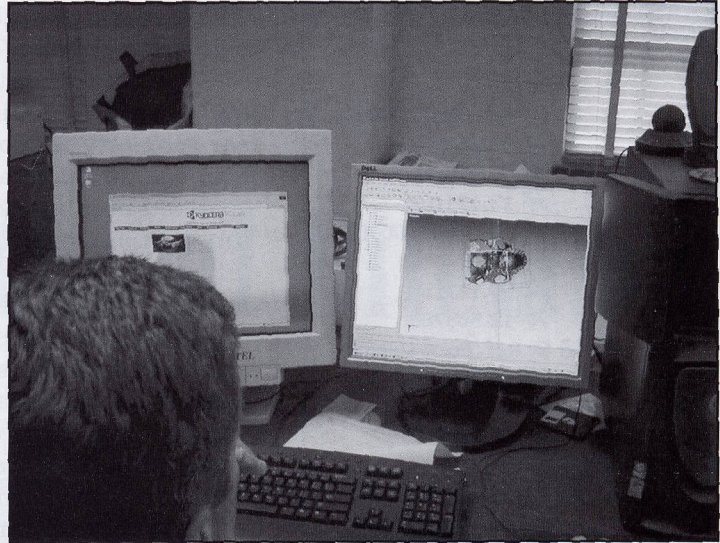The areas of coordinated functional contact were mapped by the imaging program
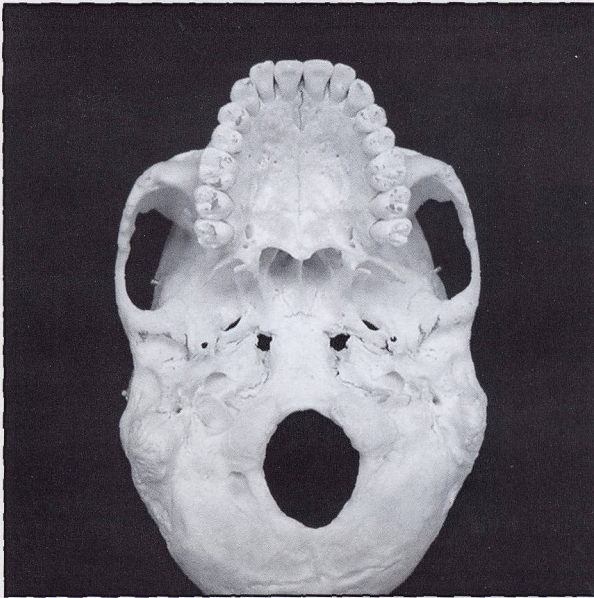

Figure 3.

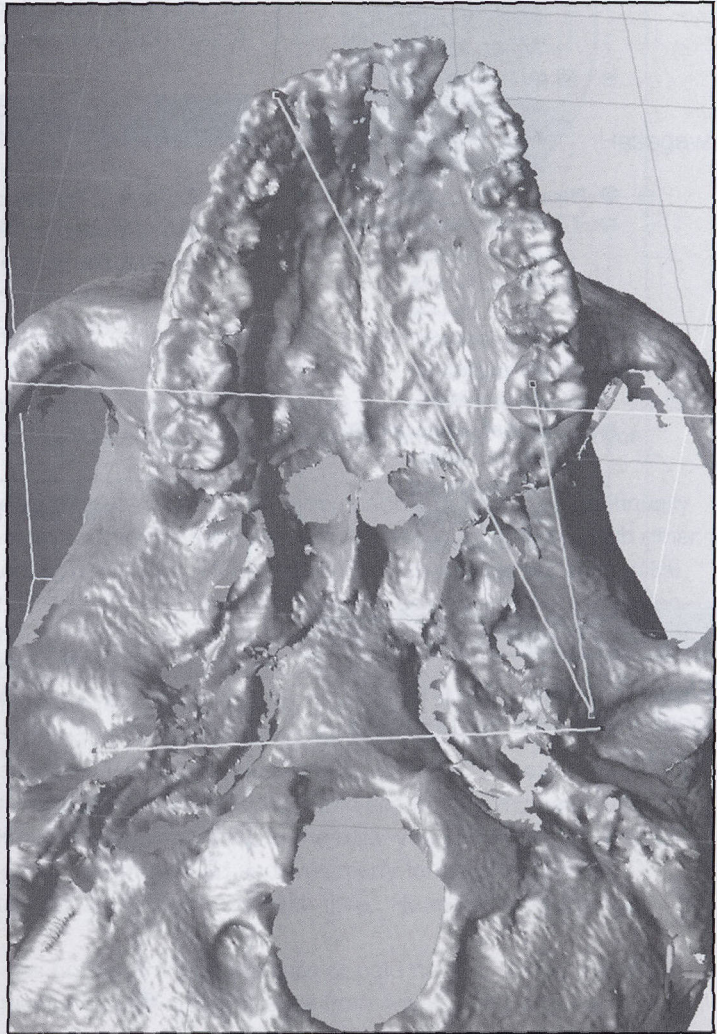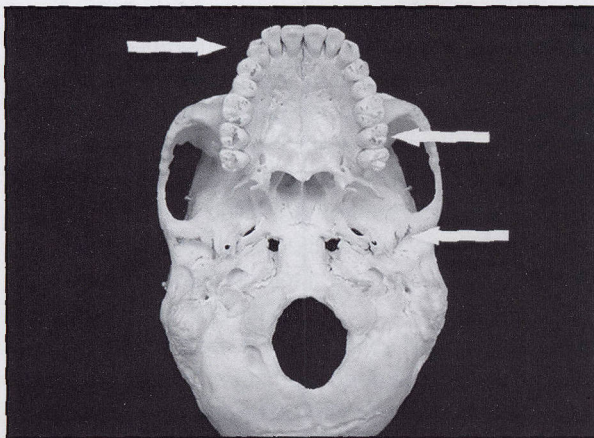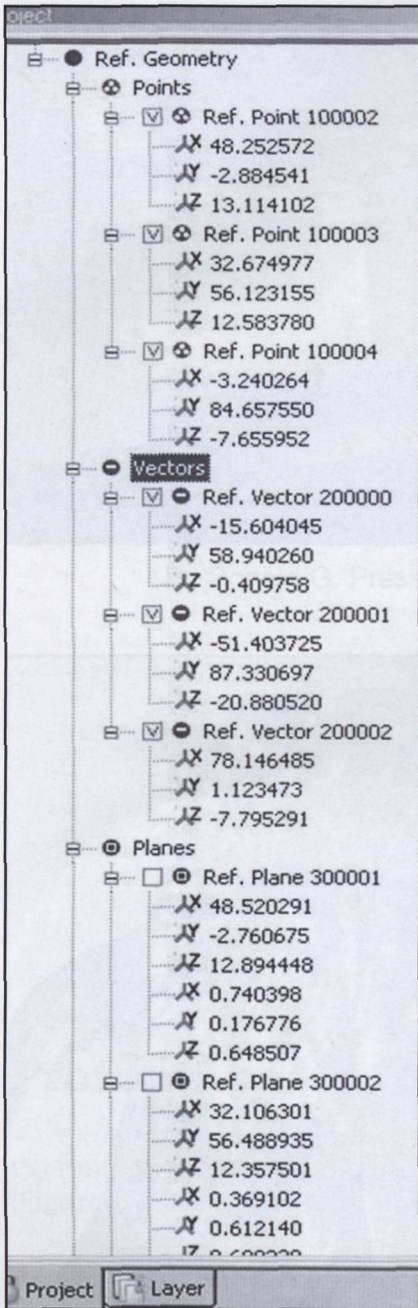**Figure 4**. Photograph of skull base showing areas of dynamic marking.

Figure 6. Test digital scan — Lab specimen at UT/Austin. Arrows indicate selected areas of contact during dynamic motion of the mandible.
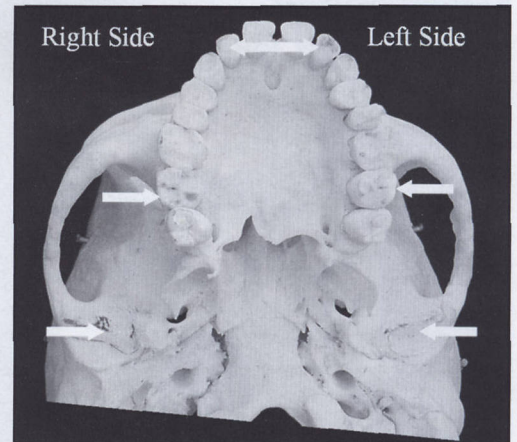

Figure 5. Digital Composite.

which, then, provided detailed mapping coordinates of these specific areas (Figure 7).

The data were then presented to two highly qualified individuals — a mathematician and an engineer — in linear and non-linear geometry for complex mathematical analysis. The first major trial was to make a mathematical model that would transpose the scanned data in a computer model to plot the selected points of function and then to demonstrate the accuracy of these plots (Figures 8 and 9). This series of analysis showed the greater majority of the digital data correlated with the scan data and the physical model (the skull). Where discrepancies were found, we assumed that the selected scan was inconsistent with the anatomical model and reassessment of the scanned images should correct the discrepancy. The study continued with the more than 80 percent of the data being accurate. The remeasurement is underway.
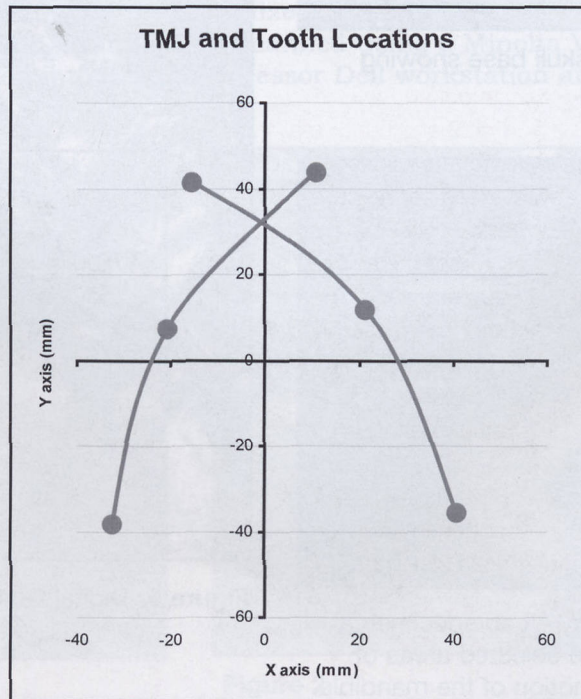
In conclusion, this series of studies substantially proved that the digital scans provide sufficient data to locate the contact planes of functioning surfaces on the teeth (wear facets) and the glenoid fossa (Zola's tubercle) (1).

REFERENCES

1. Zola A , Rothschild EA. Posterior condyle positions in unimpeded jaw movements. J Pros Dent 1962 (Sept-Oct); 11(5):873-81.

Figure 7. Spherically oriented locations of selected planes of contact.

Right Side   Left Side

Figure 8. Areas selected for analysis with RapidForm.

TMJ and Tooth Locations

Y axis (mm)

X axis (mm)

Figure 9. Plots drawn by computer using mathematical model. Correlation is excellent.