

Giancola S^{1*}, Gibelli D², Vergini S², Candolin S², Mazzarelli D², Sala R¹, Cattaneo C²

POSITIVE IDENTIFICATION BY HAND X- RAYS SUPERIMPOSITION: A QUANTITATIVE APPROACH

¹Dipartimento di Meccanica, Politecnico di Milano

²LABANOF, Laboratorio di Antropologia e Odontologia Forense, Dipartimento di Scienze Biomediche per la Salute - Università degli Studi di Milano

Learning objectives: Personal identification is one of the most sensitive fields of application of forensic anthropology for what concerns the attempt at quantifying the individualizing anatomic features. The need for a probability, already provided by genetic analyses, is even more important as the quantification of the final judgment concerning identification gives also an error, as requested by Daubert criteria for the acceptance of scientific results in trial¹. Modern computer programs allow the operators to standardize methods of comparison, in order to reach an objective evaluation concerning the identification of specific anatomic structures.

This study aims at improving method useful to identify human remains by superimposition and comparison of bones from hand and wrist on X-rays examinations.

Materials and methods: Hand and wrist X-rays from 9 adult subjects were collected. No subject was affected by pathological or traumatic lesions which may affect the shape of bones. All data were anonymized in order to reach the local ethic standards. Two individuals (n° 1 and 2) had three X-rays taken at different times Every x-ray was numbered and digitalized, and then analysed by the engineering software Halcon® 10. The software automatically elaborates a specific silhouette of a bone and finds similar items within a database: a comparison is then performed among all the selected images, resulting in a percentage of similarity. Parameters of similarity were then compared among three groups: superimpositions of an X-ray with itself, superimpositions of X-rays belonging to the same individual (n° 1 and 2), superimpositions of X-rays belonging to different individuals. Data were statistically assessed by Student's t-test.

Results and Discussion: When Halcon® 10 software elaborates the same image, percentage of similarity is in mean 99.6% (SD: 0.003%); when two X-rays belonging to the same individual are compared, the same value is 93.9% (SD: 0.04%). On the other hand, when X-rays belonging to different individuals are compared, the similarity percentage is only 76.6% (SD: 0.09%). Results

¹ Daubert v. Merrell Dow Pharmaceuticals, Supreme Court of the United States, 1993, 113 S.Ct. 2786

obtained by comparison of X-rays from the same subject and from different individuals are statistically significant ($p < 0.0001$).

Conclusion: Skeletal anatomy is unique and therefore it is useful to provide a conclusive personal identification: however methods useful to quantify such individuality begin to be developed in order to reach the criteria for admission of scientific results in trial. The present study may provide a useful method for a preliminary assessment of hand and wrist bones. Clearly further tests on a larger X-rays sample are needed in order to confirm the present results.

Keywords: forensic anthropology, identification, hand and wrist, X-ray