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PRINCIPAL METHODS FOR DETERMINING THE AGE OF SKELETAL REMAINS

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INTRODUCTION AND BACKGROUND

The age of the deceased at death is almost usually taken into account when identifying human remains. While ageing processes can occur in non-bony tissues, teeth and osseous tissue have traditionally been at the centre of most techniques[1,2].That was linked to the tissues' resistance to degeneration (soft tissues disintegrated), and age determination is frequently used in archaeological work, such as finding old and historical treasures. [3,4] In forensic situations, determining one's age at death and birth year are two sides of the same coin. They're called age-at-death methods since several of the most often used procedures were also created for use in ancient archaeology. Rarely can an archaeologically discovered individual be placed in a precise chronological context (tombstones and coffin plates aren't the only ways to identify a deceased person). However, in forensic investigations, the age of death is frequently converted to the likely year of birth (or a range) because it is a piece of evidence that can be recorded and so lead to identification.

In both forensic and physical anthropology, skeleton identification has a lengthy history. The process usually starts with the creation of a biological profile (osteobiography), which includes stature, ethnicity, sex, and age assessment [2]. When it comes to forensic identification of unidentified bodies, an individual's age is frequently a crucial piece of information. Identity theft frequently occurs in both living and deceased people, posing a dilemma for both individuals and authorities. Without age information, reconstructing a biological profile of unknown persons would be incomplete [1].

In both anthropological, palaeopathological investigations and forensic practice of skeletal remains, estimating age at death is an obligatory stage in the process of human identification. A solid estimate of the age of death becomes crucial in a few circumstances where demographic records or medical are entirely missing. Several biasing factors affect skeletal remains from ancient contexts, including post-mortem alterations, taphonomy, and diverse burial traditions based on the deceased persons' age, sex, and social standing [3]. Without age information, reconstructing a biological profile of unknown persons would be incomplete. The skeleton's developing teeth, growing structure, or degenerative changes can all be used to determine the age. Adults' periods can be calculated Using markers implicated in the resorption, deposition, and remodelling of bone. Over time, the body's everyday wear and tear are used to assess degenerative processes in adults. Human behaviour and numerous environmental conditions can affect these processes. The remodelling process differs significantly from one person to the next, and the changes made are frequently subtle and difficult to interpret [5].

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Identifying anatomical and time of life alterations in the bones or teeth is the most common way. As a result, all of these methods are relative: they don't produce findings in calendar years but rather estimations of the age of death, which can vary widely. Protein racemization and radiocarbon approaches, for example, have recently been proposed as more direct means for estimating a person's death age. When the concentration of atmospheric radiocarbon has shifted drastically from one year to the next, The so-called bomb-pulse approach and activity of radiocarbon (as measured in specific proteins of tissue) may be in equilibrium, with the latter method revealing absolute age (year of birth) [4].

Age is the most common method for identifying skeletal remains of children.
The most reliable method is assessment. The age at which a child dies is used to infer information regarding baby and child mortality rates, congenital and environmental causes, palaeodemography, growth and development, sickness, weaning ages, and infanticide in the field of biological anthropology.Non-adult age estimation relies on accurate biological to chronological age conversion and is based on a functionalskeletal or dental maturation assessment. Individual variance, the environment's impact, disease, secular changes, and heredity can all cause flaws in this conversion's precision. Most notably, males and women have different ages for their teeth and skeletal development.In forensic anthropology, there is still a lot of biological examination to be done[6].

The most commonly used methods of age estimation;

I. Anatomy

i. The teeth
ii. Pubic symphyses
iii. The rib (anterior end)
iv. The ilium(auricular surface)
v. Cranial sutures

In addition to the traditional approaches, other skeletal measures, such as assessing theacetabular surface, proximal femur, and clavicle, are frequently employed to estimate age in adults [7].

One of the most commonly used skeleton parts for age assessment is the os pubis. Methods of adult pubic symphyseal ageing currently in use integrate the morphology of developmental changes through the mid-30s with degenerative changes that occur later in life. Phase-based approaches are the most often used; nevertheless, emerging scholars and seasoned practitioners alike may not be able to specify and fully understand the existing standards for estimating age intervals[8].

The rib (anterior end)

Authors developed the traditional age estimation technique for the ribs (1984, 1985)[9]. They used a nine-phase approach to identify the age range by looking at the right rib IV's anterior (sternal) end. Rib number IV was chosen because of its ease of access during medical tests. They looked for patterns in the form, shape, texture, and general quality of the sternal ends to define phases. The medial surface changes from a flat billowy surface to a hole that deepens and grows as it gets older. The rim transitions from a rounded to a scalloped to an uneven edge as you become older. In youth, the rib is thick and firm, but it thins and becomes porous as it ages. The phase analysis was made public by several researchers, firstly for white males (1984) and later for white females (1985), because sex and ancestry can have a large impact on rib ageing (1985). Since then, many anthropologists have changed the phases for different populations [10].

The ilium(auricular surface)

An updated approach for determining adult age at death has been developed using the ilium auricular surface. It is based on Lovejoy et al. current .'s auricular surface ageing method, but it is less difficult to use and has low inter and intraobserver error. The unique method collects phases of ageing for multiple auricular surface features, which are then blended to create a composite score from which an estimated age at death can be derived [11].

Cranial sutures

Cranial sutures are also good indicators of dying age. After a person has done developing, sutures are continuously obliterated, and the degree to which distinct sutures are closed can provide good estimations. Each suture is assigned a four-point rating. Cranial suture closure is the oldest and most contentious age indicator. Although there is considerable variety in closure rates and patterns, cranial sutures normally fuse as people get older [12].

II. Radiology

A radiological assessment of age at death has been proposed by measuring the amount of trabecular bone loss at the long bones' proximal epiphyseal ends (humerus and femur). The approach, first described on macerated bone, can also be applied to the soft tissue-covered bone. In some forensic anthropological circumstances, In the early stages of an identification case (e.g., mass disasters, mass graves), age assessment may be helpful without the requirement to macerate the remains of soft tissue removal is not possible. Several mentioned morphological approaches, including age indications based on 3D visualizations and computed tomography (CT) scans. This is due, in part, to forensic institutes' increasing use of CT scanning prior to autopsy.

Early research compared CT scan images and/or 3D representations to the highlighted phases (e.g., scoring sternal (anterior end) of rib, closure ofsuture, and symphysis of pubic), but additional work has subsequently been done to explicitly define phases or stages utilizing CT information. Trabecular structural alterations have only been studied in a few studies. Only a few research have assessed trabecular structural alterations or quantified curvature in the symphysis pubic; thus, it's feasible that other approaches may use digital information from a CT scan in the next, instead of simply strictly morphological, visual (reconstructed) data.Aside from the fact that CT has a far broader use, it's also worth noting that it may be used as a foundation for a lot more reference data. Treatments for dry bone have been devised for a variety of anatomical collections. (for example, the “Terry collection at the Smithsonian Institution”), in other words, the collection's age composition may transfer over to those methods.

Furthermore, the collections represent human skeletal changes from over a century ago, causing some to wonder if they're still applicable in today's forensic investigations. Because

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of the availability of an updated digital database with CT scans, many approaches may now be examined and new ways constructed on this material. Many procedures of forensic anthropological for estimating agehave been available for a long time (some for over a century) with variations and are part of the fundamental forensic anthropological toolbox.

Common approaches include identifying age-related morphological skeletal features and categorizing them intostages system or scores to offer an interval of estimated age. This methodological technique has several problems: whether or not a chosen morphological method is properly explained or defined to reduce excessive intra- or interobserver error when used (for example, In assessing anatomical traits, there should be no considerable uncertainty). In addition, quantifying the degree of observer variance for each method is critical since the findings of a forensic anthropological investigation may be submitted in court. As a result, it's vital to evaluate the method's validity, including intra- and interobserver testing [13, 14].

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