

Sealed Osteons: A Pathological Consequence or Natural Circumstance of Extensive Remodeling?

TANNER R. HENRIE, MATTHEW DALTON, JOHN G. SKEDROS¹,
¹ Dept. of Orthopaedics, Univ. of Utah School of Medicine, Salt Lake City, Utah

Sealed osteons (SeO) are unusual secondary osteon (Haversian system) variants. They are defined as the continuation of osteonal infilling resulting in complete obliteration of the Haversian canal (canal fully sealed with bone) (Congiu and Pazzaglia("C&P"), 2011 Anatomical Record). SeO do not represent micropetrosis (central canal "plugging") or osteocyte lacuna plugging with hypermineralized tissue related to aging; SeO are "sealed" with apparently normal bone. SeO are rarely studied; C&P reported 4-5% SEOs of all secondary osteons from three tibiae (post-traumatic amputations; ages 25, 28, 52; all males). They suggest SeO are the natural/physiological consequence of ischemia that sporadically occurs during remodeling (i.e., some osteons seal because their blood supply is diminished or cutoff during formation of nearby/adjacent osteons). We hypothesized a similar prevalence of SeO would be found in various non-primate, highly remodeled bones (deer, sheep and horse calcanei; sheep and horse radii, sheep tibiae; horse third metacarpals) and from modern human femora where an aging effect might be detected (35-71 years; n=10, male:female=8:2). SeO occurred in <0.1% secondary osteons in non-primate bones even in extensively remodeled regions (i.e., much greater %osteonal bone than humans) and ~1% in human femora, but without an age-related increase. The 4-5 fold higher prevalence of SeO identified by C&P might reflect ischemia preceding and/or caused by the trauma/amputation in the three tibiae that they examined. If correct, then these unusual osteon variants should be viewed as a pathological consequence, not the outcome of ischemia caused by natural extensive osteonal remodeling. Perhaps they represent sealing of the 'closing cone' of some secondary osteons.