

## Skeletal and dental features associated with the phases of pubertal maturation in boys and girls

	Phase	External Physical changes	Canine Mineralisation <sup>1</sup>	Hamate Hook <sup>2</sup>	Hand Phalanges <sup>3</sup>	Wrist <sup>3</sup> (fusion score)	Iliac Crest <sup>4</sup> (fusion score)	CMV <sup>5</sup>
0	Pre-Puberty		E	Stage G Hook absent	Stage 1 Proximal epiphysis of hand phalanges narrower than shaft	Stage 1 Distal radius unfused (0) Humerus capitulum unfused (0)	Risser 1 Epiphysis not present	1
1	Initiation (onset)	Ovaries enlarge Hormones released	F Root ½ to 3/4	Stage G Hook absent	Stage 1 Proximal epiphysis of hand phalanges narrower than shaft	Stage 1 Distal radius unfused (0) Proximal ulna unfused (0) Humerus capitulum unfused (0)	Risser 1 Epiphysis not present	1
2	Acceleration	Breast buds Pubic hair Increased body mass	G/H Root complete to apex 1/2	Stages H or H.5 Hook appearing or increased	Stage 2 Phalangeal epiphyses of equal width to shaft	Stage 1 Distal radius unfused (0) Proximal ulna unfused (0) Humerus capitulum unfused (0)	Risser 2 Epiphysis 50% complete, unfused	2
3	PHV (transition)	Breast development Musculature Voice breaks	H Apex complete	Stage I Hook complete	Stage 3 Capping of phalangeal epiphyses	Stage 2 Distal radius unfused (0) Proximal ulna fusing/fused (1-2) Humerus capitulum fusing (1)	Risser 2-3 Epiphysis 50-75% complete, Unfused (0)	3
4	Deceleration	Menarche Ovulation	H Apex complete	Stage I Hook complete	Stage 4 phalangeal epiphyses fusing (1) (menstruation = fusion of the distal phalanx of MC2)	Stage 3 Distal radius unfused (0) Proximal ulna fused (2) Humerus capitulum fused (2)	Risser 3-4 Epiphysis 75-100% complete, Non to partial union (0-1)	4-5
5	Maturation	Regular ovulation Outwardly sexually mature	H Apex complete	Stage I Hook complete	Stage 5 phalangeal epiphyses fusing (1)	Stage 4 Distal radius fusing (1)	Risser 4 Epiphysis 100% complete, partial union (1)	5-6
6	Completion (post-puberty)		H Apex complete	Stage I Hook complete	Stage 6 Phalanges fused (2)	Stage 5 Distal radius fused (2)	Risser 5 Fusion complete (2)	6

<sup>1</sup>. Cherkow (1980) based on Demirjian et al.'s dental stages (1973); Grave and Brown (1976); Chertkow (1980); Shapland and Lewis (2013); <sup>2</sup>. Grave and Brown (1976); Hägg and Taranger (1982) for the phalangeal epiphyses; Hägg and Taranger (1982) and Zhang et al. (2008) for the distal radius. <sup>3</sup>. Hewitt and Anderson (1961a, b) (a and b); Scoles et al. (1987); Scheuer and Black (2000); <sup>4</sup>. Hassel and Farman (1995) for cervical vertebra 3, Baccetti et al. (2002) for cervical vertebrae 2-4, Shapland and Lewis (2014).