

Supplemental Digital Content 2. Definition of cephalometric distances, angles, ratios and planes

Variable	Abbreviation	Definition
Cranial base		
Inner linear measurements		
anterior cranial fossa base width	ACF	the minimum interorbital distance measured at the posterior globe of coronal slides
Nasion-Basion	N-BA	the distance between Nasion and Basion, indicates the cranial base length
Sella-Basion	S-BA	the distance between Sella and Basion, indicates the posterior cranial base length, clivus length
Sella to Spheno-occipital Synchondrosis	S-SO	the distance between Sella and Spheno-occipital Synchondrosis, related to cranial base length, clivus height
Spheno-occipital Synchondrosis to Basion	SO-BA	the distance between Spheno-occipital Synchondrosis and Basion, indicates the length of basilar part of occipital bone in the midsagittal plane
Basion-Opisthion	BA-OP	the distance between Basion and Opisthion, indicates the anteroposterior length of foramen magnum
Spheno-occipital Synchondrosis to Ethmo-sphenoid	SO-ES	the distance between Spheno-occipital Synchondrosis and Ethmo-sphenoid, indicated the anteroposterior length of sphenoid in the midsagittal plane
Sella to Ethmo-sphenoid	S-ES	the distance between sella and ethmo-sphenoid, related to sphenoid endocranial length in sagittal plane
Sella-Nasion	S-N	the distance between point Sella and Nasion, indicates the anterior cranial base length
Nasion to ethmoid-sphenoid	N-ES	the distance between Nasion and ethmoid-sphenoid, indicates the ethmoid length in anterior cranial fossa
Angular measurements		
Sphenoid greater wing divergence		measured from the plane pass the midpoint of bilateral most infront points of corneas and parallel to Frankfort horizontal plane
Separation of lateral pterygoid	PPR-S-PPL	the angle between bilateral lateral pterygoid plates, measured by connecting points PPR, S and PPL
Nasion-Sella-[Spheno-occipital Synchondrosis]	N-S-SO	indicates the middle and anterior cranial base angle
Sella-[Spheno-occipital Synchondrosis]-basion	S-SO-BA	indicates the posterior cranial base angle
Sphenoid Angle	BA-S-ES	corresponding to the degree of backward rotation of the sphenoid, indicates the posterior and middle cranial base angle
Nasion-Sella-Basion	N-S-BA	indicates the cranial base angle in brain side
Nasion-[Spheno-occipital Synchondrosis]-Basion	N-SO-BA	indicates the cranial base angle in facial side
External linear measurements		

Basion-Posterior nasal spine	BA-PNS	the distance between basion and posterior nasal spine, related to the distance of posterior cranial base to posterior nasal spine, the anteroposterior diameter of airway
Nasion-Posterior nasal spine	S-PNS	the distance between nasion and posterior nasal spine, related to the distance of middle cranial base to posterior nasal spine
Ethmoid-sphenoid to Posterior nasal spine	ES-PNS	the distance between the suture of ethmoid-sphenoid and posterior nasal spine, related to the distance of anterior cranial base to posterior nasal spine
Nasion-Posterior nasal spine	N-PNS	the distance between nasion and posterior nasal spine
Basion-Anterior nasal spine	BA-ANS	the distance between basion and anterior nasal spine, indicates midfacial length
Sella-Articulare	S-AR	the distance between sella and articulare, related to the height of cranial base

Craniofacial relationship

linear measurements

Sella-Nasion	S-N	the anterior cranial base length
Sella-Anterior nasal spine	S-ANS	the distance between sella and anterior nasal spine
Sella-A point	S-A	the distance between sella and A point
Sella-B point	S-B	the distance between sella and B point
Sella-Pogonion	S-Pog	posterior facial height
Y Axis	S-GN	the distance between sella and Gnathion
Nasion-Posterior nasal spine	S-PNS	the distance between nasion and posterior nasal spine
Sella-Gonion	S-GO	the posterior total facial height right
Sella-Articulare	S-AR	the distance between sella and articulare
Anterior nasal spine-Basion	ANS-BA	midfacial length
Anterior nasal spine-Nasion	ANS-N	the anterior midfacial height
Anterior nasal spine-Menton	ANS-Men	anterior lower facial height
Nasion-Menton	N-Men	anterior total facial height
upper anterior facial height- upper posterior facial height	N-ANS/S-PNS	indicates ratio of upper anterior facial height to upper posterior facial height
Lower facial height/Total facial height	ANS-Men/N-Men	Indicates ratio of lower to total facial heights
Posterior facial height-Anterior facial height	S-GO/N-Men	indicates ratio of posterior and anterior facial heights
Modified 3-D Wit's measurement	Wit's	The modified 3-D Wit's measurement is a projective linear measurement between the 3-D cephalometric hard tissue A point and B point landmarks that are projected perpendicular on the 3-D occlusal plane

Angular measurements

Sella-Nasion-A point	SNA	indicates the sagittal position of the maxilla relative to the cranial base.
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Sella-Nasion-B point	SNB	indicates the sagittal position of the mandible relative to the cranial base.
A point-Nasion-B point	ANB	the relative position of the maxilla to the mandible
Nasion-Sella-Articulare	N-S-AR	corresponding to cranial base angle
Nasion-Sella-medial pterygoid plate	N-S-PP	corresponding to the degree of backward rotation of the pterygoid plates
Nasion-Sella-Gnathion	N-S-GN	the relative position of gnathion to cranial base
Nasion-A point-Pogonion	N-A-Pog	indicates facial convexity angle
Sella-Nasion-Pogonion	S-N-Pog	indicates the sagittal position of the chin to anterior cranial base

Planes

Sella-Nasion plane	SN	The plane passing through sella and nasion landmarks and perpendicular to midsagittal plane
Frankfort horizontal Plane	FH	The Frankfort horizontal plane is defined by a plane that passes the midpoint of both Orbita (Orbital and Orbital) landmarks and the midpoint of the two Porion (Porionr and Porionl) landmarks, and perpendicular to midsagittal plane
Maxillary plane	Mx	The maxillary plane is defined by a plane that passes the anterior nasal spine and posterior nasal spine landmarks, and perpendicular to midsagittal plane
Occlusal plane	Occ	The occlusal plane is defined by a plane that passes the mean of upper and lower Incisor landmarks in both sides and the mean of upper and lower molar landmarks in both side, and perpendicular to midsagittal plane
Mandibular plane	MP	The mandibular plane is defined by a plane that passes the menton and the mean of both Gonion landmarks, and perpendicular to midsagittal plane
Mandible ramus plane	MRP	The plane passes the mean of bilateral gonions and the mean of bilateral condylions, and is perpendicular to midsagittal plane

Orbit

Unilateral orbital feature

orbit length		the distance from the zygomaticomaxillary suture on the orbital rim to the optic foramen
orbit height		the distance between the midsuperior and midinferior orbital rim on a sagittal plane crossing the apex corneae
orbit width		the distance between the most anterior portion of the medial and the lateral orbital walls on an axial plane crossing the apex corneae.
vertical cone angle		Angulation of the vertical walls of the posterior orbit as defined by three points: the superior most point of the orbital roof, vertex at the optic foramen, and inferior point on the orbital floor in the same sagittal slice as the superior point
horizontal cone angle		the angle was measured on the slide pass the midpoint of bilateral corneae and parallel to FH plane, vertex at the optic forament, the others two points were the anterior most point of lateral orbital wall and the medial point of ethmoid bone
orbit rim angle		angle of orbital rim plane to middle sagittal plane. The orbital rim plane defined by points on the orbital rim: supraorbital notch, zygomaticofrontal suture and zygomaticomaxillary suture
Globe Projection		the distance from the most anterior point of cornea to the orbital rim plane
visual axis length		the distance between corneae and optic foramen

Condylion-Gonion/Gonion-Pogonion	CO-GO/GO-Pog	the ratio of mandibular ramus height to mandibular body effective length
Angular measurements		
Condylion-Gonion-Menton	COR/L-GOR/L-Men	the gonial angle
Articulare-Gonion-Mention	ARR/L-GOR/L-Men	the gonial angle
Articulare-Gonion-Nasion	ARR/L-GOR/L-N	the upper gonial angle
Nasion-Gonion-Menton	N-GOR/L-Men	the lower gonial angle
Right-Left [Condylion-Antegonial notch-Menton]	[CoR-AGR-Men]- [CoL-AGL-Men]	the angle between bilateral mandibular planes
