OPEN ACCESS

University of Dundee

University of Dundee

Quantification of maxillary dental midline deviation in 2D photographs

Alarabi, Abdulghani M.; Revie, Gavin F.; Bearn, David R.

Quantification of maxillary dental midline deviation in 2D photographs: methodology trial.

Table 1: Anatomical landmarks used to identify the facial midline in 2D photographs

Eyebrows (EB)	The strip of hair growing on the ridge above a person's eye socket.
Inner canthus of the eyes (ICE)	The angle at the medial margin of the eyelid.
Alae of the nose (AN)	Lateral portions of the external nose (the lateral rim of the nostril)
Columella (C)	It's the midline nasal soft tissue anterior to the septum separating the two nares.
Nasolabial folds (NLF)	The skin folds that run from each side of the nose to the corners of the mouth during smiling.
Philtrum (PH)	The centre of the vertical groove in the midline on the external surface of the upper lip, passing through the cupids' bow of the upper lip.

Quantification of maxillary dental midline deviation in 2D photographs: methodology trial.

Table 2: Means, standard deviation, and bootstrapped 95% confidence interval for the absolute measurement errors at each reference point in all head positions, and arranged in ascending order

Reference points	Means	Standard deviation	bootstrap 95% Confidence Interval	
			Lower	Upper
AN	1.70	1.18	1.36	2.07
PH	2.16	1.65	1.70	2.61
EB	2.41	2.07	1.86	3.06
NLF	3.45	2.83	2.71	4.37
ICE	3.59	3.34	2.69	4.64
C	5.50	3.86	4.44	6.75
bootstrap results are based on 1000 bootstrap samples				

Quantification of maxillary dental midline deviation in 2D photographs: methodology trial.

Table 3: Means, standard deviations and bootstrapped 95% confidence interval for the absolute measurement errors at each head position in all reference points

Head positions	Means	Standard deviations	bootstrap 95% Confidence Interval	
			Lower	Upper
R20	6.18	4.15	4.74	7.67
R15	5.36	3.71	3.97	6.72
R10	3.95	2.53	3.05	4.90
R5	2.60	1.91	1.96	3.34
0	1.31	0.97	0.99	1.67
L5	1.24	0.80	0.97	1.55
L10	1.83	1.29	1.38	2.27
L15	2.54	1.92	1.89	3.27
L20	3.19	2.46	2.40	4.15
bootstrap results are based on 1000 bootstrap samples				

Quantification of maxillary dental midline deviation in 2D photographs: methodology trial.

Table 4: Standard deviations of the absolute measurement errors for each reference points at each head position

	20R	15R	10R	5R	0	5L	10L	15L	20L
EB	2.591963	2.537321	2.084759	1.340034	1.010881	1.000875	1.64156	2.542463	2.286668
ICE	5.067442	4.62506	2.644453	1.421045	0.915598	1.250168	0.821298	1.604952	1.487202
AN	1.317054	1.34884	1.935776	0.471519	0.347779	0.419726	0.720868	1.003778	1.276154
C	2.589716	2.94814	1.986437	2.092009	1.423808	0.775326	1.82968	2.232279	2.709858
NLF	3.439908	3.188711	2.207967	1.549235	0.901155	0.69995	0.800156	1.365456	2.472023
PH	2.050285	2.137702	1.230914	1.321166	0.402331	0.490439	1.051798	1.20647	1.689595

🟥 Highest SD within column (in each head position)
🟩 Lowest SD within column

Quantification of maxillary dental midline deviation in 2D photographs: methodology trial.

Table 5: Root Mean Square Error (RMSE) for the reference points used to detect facial midline

Reference points	RMSE (mm)
AN	1.46mm
PH	1.91mm
EB	2.20mm
NLF	3.14mm
ICE	3.45mm
C	4.73mm

Quantification of maxillary dental midline deviation in 2D photographs: methodology trial.

Table 6: The Method of Moment's Estimators (MME) for reference points used to detect facial midline

Reference points	MME (mm)
AN	1.47mm
PH	1.92mm
EB	2.22mm
NLF	2.75mm
ICE	2.9mm
C	4.56mm

Quantification of maxillary dental midline deviation in 2D photographs: methodology trial.

Table 7: The back transformed estimated marginal means with the 95% CI for the absolute measurement errors (in mm) at each reference point in all head positions

Reference point	Head position	Mean	95% CI Lower Bound	95% CI Upper Bound
EB	R 20	3.64	1.02	7.87
	R 15	3.42	0.84	7.73
	R 10	2.81	0.75	6.17
	R 5	1.43	0.34	3.28
	Zero	0.88	0.11	2.36
	L 5	1.20	0.09	3.59
	L 10	2.13	0.48	4.96
	L 15	1.33	0.00	5.23
	L 20	1.61	0.17	4.52

Reference point	Head position	Mean	95% CI Lower Bound	95% CI Upper Bound
ICE	R 20	7.67	3.09	14.32
	R 15	6.12	2.11	12.23
	R 10	4.29	1.86	7.70
	R 5	3.38	1.96	5.18
	Zero	1.91	0.92	3.26
	L 5	1.37	0.18	3.68
	L 10	1.38	0.61	2.46
	L 15	1.57	0.24	4.06
	L 20	2.17	0.67	4.51

Reference point	Head position	Mean	95% CI Lower Bound	95% CI Upper Bound
AN	R 20	2.40	1.03	4.33
	R 15	2.11	0.84	3.96
	R 10	1.83	0.25	4.85
	R 5	0.98	0.51	1.62
	Zero	0.74	0.35	1.28
	L 5	0.93	0.48	1.53
	L 10	1.32	0.55	2.41
	L 15	1.72	0.71	3.18
	L 20	2.13	0.84	4.00

Reference point	Head position	Mean	95% CI Lower Bound	95% CI Upper Bound
C	R 20	11.04	8.09	14.46
	R 15	9.59	6.29	13.59
	R 10	6.90	4.63	9.61
	R 5	4.39	2.20	7.31
	Zero	1.01	0.12	2.77
	L 5	1.18	0.41	2.36
	L 10	2.41	0.29	6.60
	L 15	4.63	2.23	7.90
	L 20	6.41	3.58	10.07

Reference point	Head position	Mean	95% CI Lower Bound	95% CI Upper Bound
NLF	R 20	7.12	3.68	11.68
	R 15	5.87	2.80	10.08
	R 10	4.40	2.17	7.40
	R 5	3.56	1.99	5.58
	Zero	1.86	0.89	3.19
	L 5	1.08	0.41	2.06
	L 10	1.05	0.30	2.26
	L 15	1.90	0.51	4.17
	L 20	2.11	0.08	6.87

Reference point	Head position	Mean	95% CI Lower Bound	95% CI Upper Bound
PH	R 20	3.38	1.12	6.85
	R 15	3.09	0.93	6.51
	R 10	1.99	0.57	4.29
	R 5	0.84	0.00	3.20
	Zero	0.76	0.29	1.47
	L 5	0.75	0.17	1.73
	L 10	1.28	0.15	3.51
	L 15	2.46	1.23	4.12
	L 20	2.84	1.18	5.21