



Introduction

- Immediate implant placement in the anterior maxilla can be as successful as early implant placement or delayed implant placement with alveolar ridge preservation
- Perforation of nasal fossa or nasopalatine canal (NPC) is not uncommon when placing immediate implants in sites of maxillary central incisors (**fig. 1**) (**fig. 2**)
- Practitioners may not be as aware of these structures when compared with awareness of the maxillary sinus in posterior sites
- Perforation of the nasal fossa can cause similar sinus issues, or even lead to spontaneous nasal expulsion
- Enucleation of the NPC may be a clinical possibility

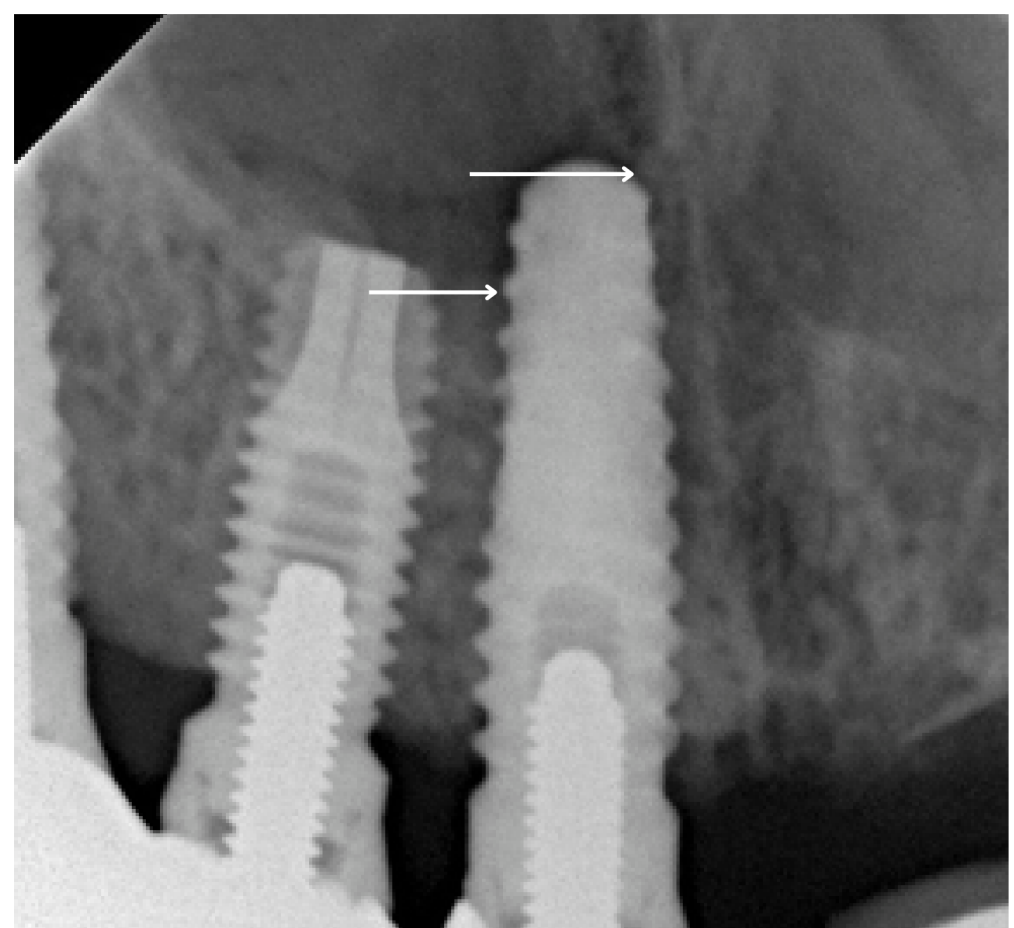


Figure 1. Implant perforation of the nasal fossa can cause altered nasal airflow. (Wolff et al., *Int J Implant Dent.* 2016)

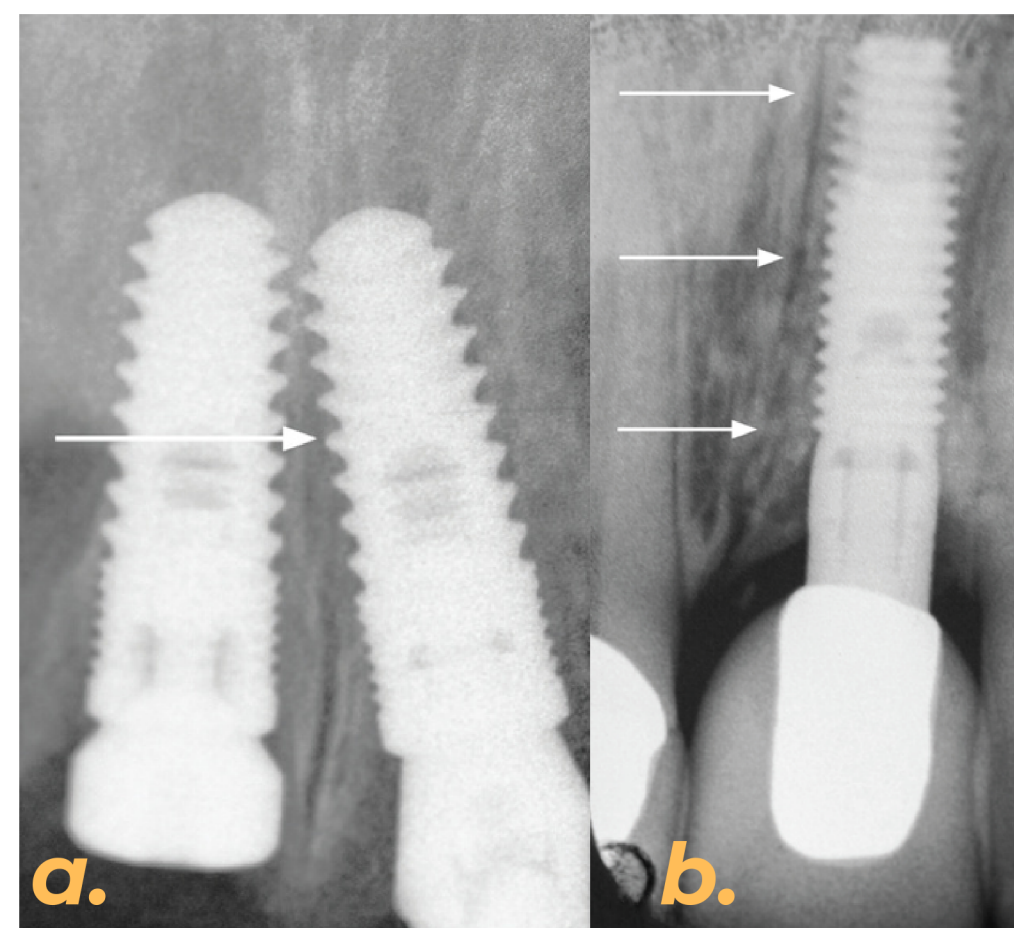


Figure 2a. The NPC can be enucleated or grafted before successful implant placement.
b. Implants can be angled distally to avoid the NPC. (Cavallaro et al., *Compend Contin Educ Dent.* 2016)

Methods

- Patients were included with a CBCT scan of both atraumatically retained maxillary central incisors (#8, #9)
- Patients were excluded in cases of missing central incisors, abnormal pathology, or traumatic history in the incisal area
- 5 measurements were taken relative to each incisor for all patients (**fig. 3**) (**fig. 4**)
 - **Parameter 1:** Distance from incisal root apex to floor of nasal fossa
 - **Parameter 2:** Distance from incisor to NPC at crestal level (buccal cortical plate)
 - **Parameter 3:** Distance from incisor to NPC at mid-root level
 - **Parameter 4:** Distance from incisor to NPC at apical level (incisal root apex)
 - **Parameter 5:** Lateral width of NPC at mid-root level
- Data was further separated by gender, age group, and incisal position (#8, #9)
- Genders (only male and female reported) were compared using unpaired t-tests
- Age groups were compared using single-factor ANOVA

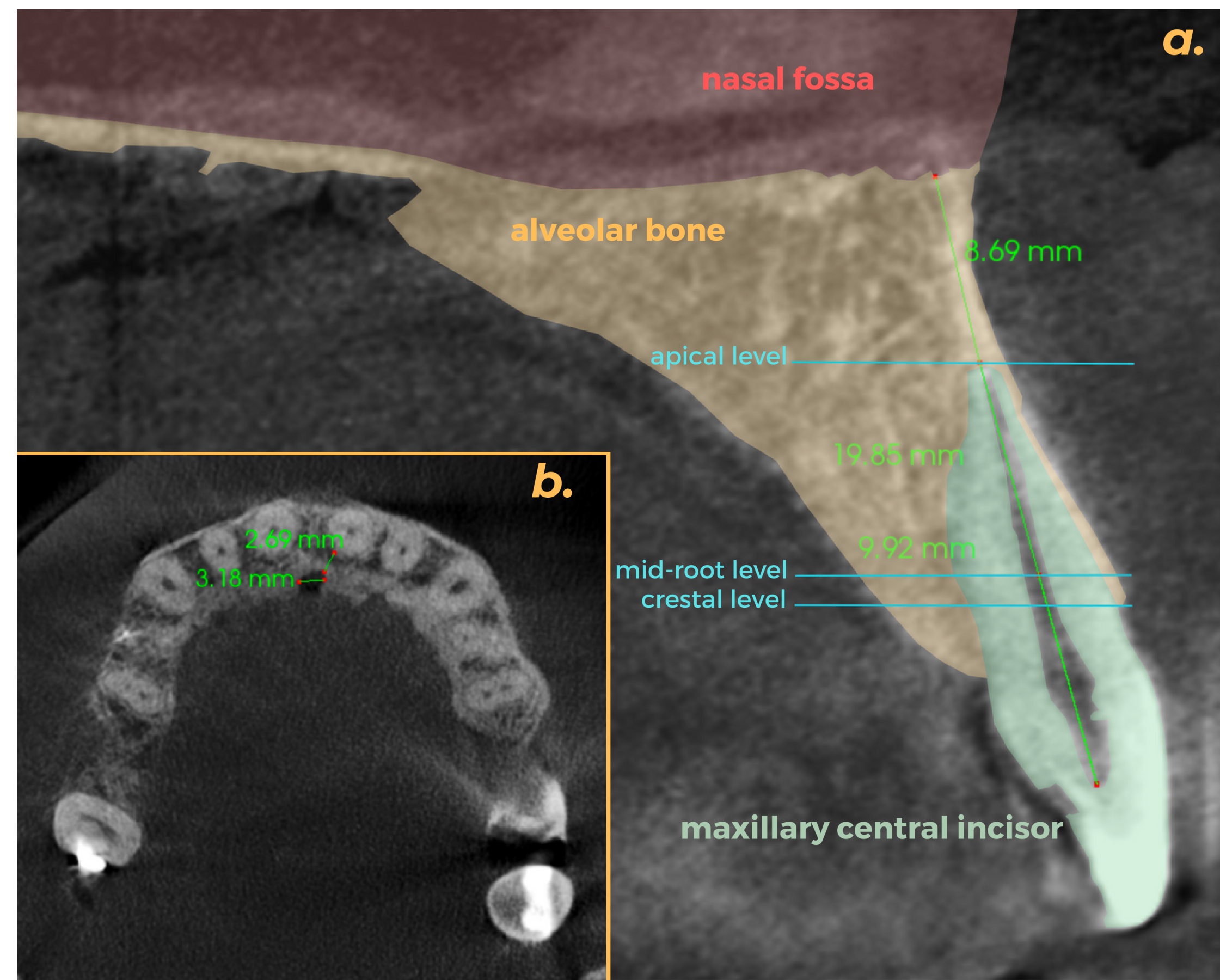


Figure 4a. From the sagittal view of the middle of incisal root, parameter 1 was measured. Crestal level was aligned with coronal edge of buccal cortical plate. Mid-root level was determined mathematically by measuring root length. Apical level was determined by visualizing root apex.
b. Measurement of parameters 3 and 5 using axial view of mid-root level of incisor #9.

Results

- 140 patients were analyzed from ECU School of Dental Medicine database (**table 1**)
 - Means and standard deviations represent pooled data between both maxillary incisors

Table 1. Means and standard deviations of each measurement, sorted by group.

	Number of cases	Distance to nasal fossa	Incisor-NPC distance (crestal)	Incisor-NPC distance (mid-root)	Incisor-NPC distance (apical)	Lateral NPC width (mid-root)
Overall	140	7.23±2.80	1.72±0.76	1.97±0.85	4.27±1.55	4.45±0.98
Male	55	7.22±2.56	1.85±0.74	2.12±0.82	4.38±1.66	4.56±1.09
Female	85	7.23±2.96	1.64±0.77	1.87±0.85	4.20±1.48	4.38±0.89
Ages 18-39	20	6.54±2.78	1.59±0.86	1.78±0.96	4.21±1.64	4.38±1.05
Ages 40-49	12	5.84±2.81	1.77±0.77	1.98±0.67	3.99±1.57	4.52±0.82
Ages 50-59	36	6.93±2.26	1.74±0.71	1.92±0.75	4.29±1.58	4.48±1.12
Ages 60-69	45	7.41±2.68	1.83±0.77	2.05±0.92	4.46±1.45	4.38±0.90
Age 70+	27	8.45±3.23	1.61±0.74	2.02±0.81	4.11±1.61	4.55±0.93

All measurements in mm.

- Distance from root apex to floor of nasal fossa tends to increase with increased age (**table 1**)
 - However, variance also increases in older age groups for parameter 1
- 4mm of distance from apical tip of implant to the floor of the nasal fossa is indicated for immediate implant placement (**fig. 5a**) (**table 2**)
- 2mm of distance from implant edge to NPC is indicated for immediate implant placement (**fig. 5b-d**) (**table 2**)

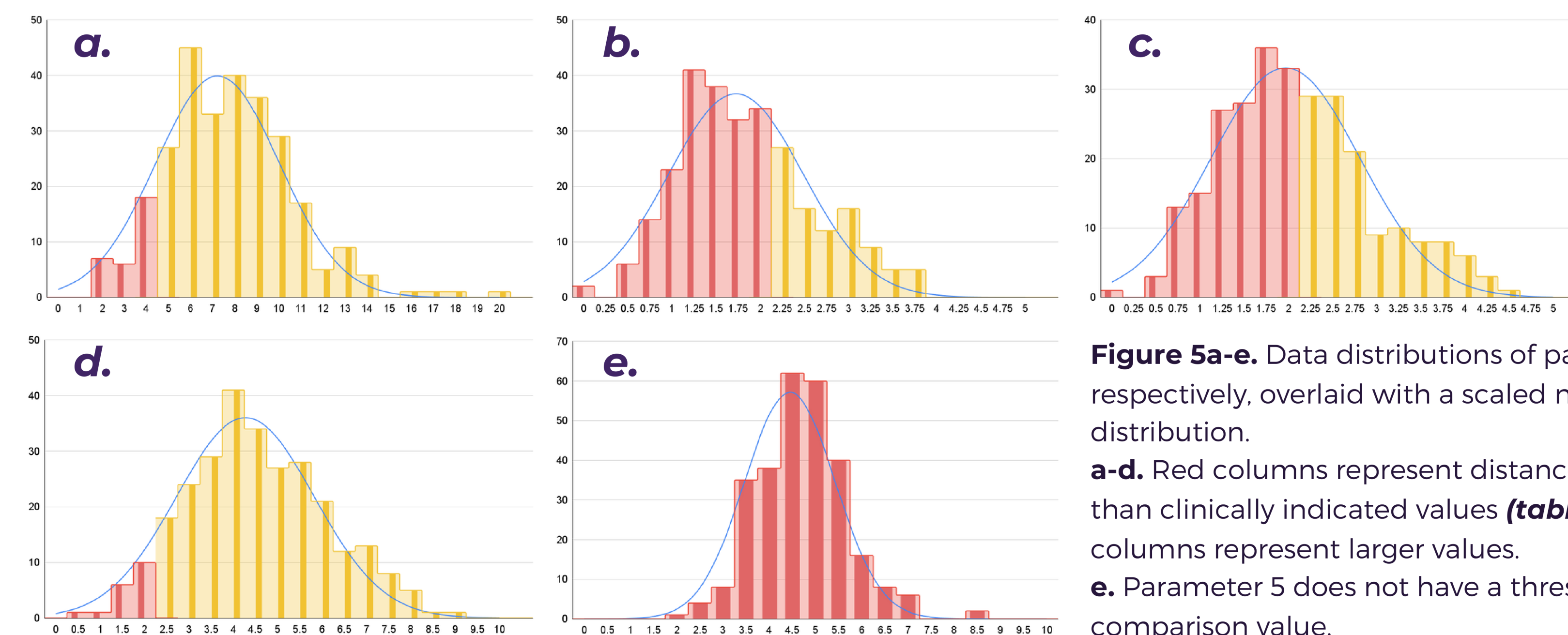


Figure 5a-e. Data distributions of parameters 1-5, respectively, overlaid with a scaled normal distribution.
a-d. Red columns represent distances smaller than clinically indicated values (**table 2**), yellow columns represent larger values.
e. Parameter 5 does not have a threshold comparison value.

- Distance from root apex to nasal fossa shows statistically significant differences between age groups (**table 2**)
- Distance from incisor to NPC is significantly smaller in women than men at crestal and mid-root levels (**table 2**)
- Distance from tooth #9 to NPC at apical level is smaller than the same distance from tooth #8, but only in men ($p<0.01$); this difference did not present itself in women ($p=0.87$)

Table 2. p -values for statistical tests comparing genders, ages; distribution of cases less than the clinically indicated value

	Distance to nasal fossa	Incisor-NPC distance (crestal)	Incisor-NPC distance (mid-root)	Incisor-NPC distance (apical)	Lateral NPC width (mid-root)
Between genders	0.96	0.02*	0.01*	0.38	0.15
Between age groups	<0.01*	0.37	0.53	0.60	0.84
N (%) of overall cases less than clinical threshold (fig 5a-d.)	31 (11.07%)	190 (67.86%)	156 (55.71%)	18 (6.43%)	N/A

$\alpha = 0.05$

Discussion

- Immediate implants are generally preferred in the anterior maxilla
- Distribution of distances from incisal root apex to the floor of the nasal fossa indicates adequate immediate implant stability in most patients (**fig. 5a**) (**table 2**)
- Distributions of distances from incisal edge to NPC indicate large percentage of patients have less than clinically indicated space at the crestal and mid-root levels (**fig. 5b-c**)
- Further research needed to determine causes of age-related difference in distance to the nasal fossa, impact of tooth angulation and overjet on distances to NPC

Conclusion

- Clinicians should be aware of vital anatomy in the anterior maxillary area when placing immediate implants
- Care must be taken when avoiding nasopalatine canal at middle root level and above (coronally), especially in female patients
- Elderly patients may have longer distance to the nasal fossa, when considering immediate implant placement

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