

Alterations and Pathologies Prevalence in Panoramic Radiographs in Patients Attending the University Dental Clinic

Prevalencia de Alteraciones y Patologías en Radiografías Panorámicas en Pacientes Atendidos en una Clínica Dental Universitaria

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ABSTRACT: The aim was to report the prevalence of alterations and pathologies of the analysis of digital panoramic radiographs in the clinic of the Dental School at Escuela Nacional de Estudios Superiores, Unidad León, since October 2011 until April 2012. This was developed as a retrospective study involving 516 digital panoramic radiographs upon which was performed a visual analysis to report the prevalence of abnormalities or pathologies. The findings were related to maxillary sinus abnormality or pathology, nasal cavity, maxillary and mandibular bones and dental abnormalities. The panoramic radiograph because of its versatility is still one of the most important oral and maxillofacial diagnosis methods, it helps us to detect pathologies, which do not always have symptomatology and could cause health problems.

KEY WORDS: panoramic radiograph, maxillary sinus, nasal cavity, maxilla, mandible.

INTRODUCTION

Radiographs are useful diagnostic aids necessary to complete a proper dental chart. Based on the description of the symptoms from the patient, as well as a physical examination, one can determine what kind of diagnostic tool is most appropriate to corroborate, extend or confirm a diagnosis and develop a proper treatment plan.

The radiographs used in dentistry are classified as extra or intraoral. Each of these film types gives us particular diagnostic features useful for the diagnosis. The admission clinic of the Dentistry School at the Escuela Nacional de Estudios Superiores (ENES), Unidad León, performs a radiographic examination for all patients who come for dental care in order to give a comprehensive diagnosis and an appropriate treatment plan.

Within extraoral radiographs, panoramic radiography is the most widely used to supplement an oral diagnosis (Guimarães *et al.*, 2011). Since its introduction to the dental practice by Paatero in 1952,

it has become an important diagnostic tool (Choi, 2011; Ladeira *et al.*, 2010). The images that offers, allows us an overview of the maxillary structures and its teeth relationships. Its properties also give us a broad view of the structures of the mid and lower face and its relation to the maxillofacial complex. This X-ray does generate distortions in the mesial-distal due to the process through which the image is generated, which limits the specific assessment of anatomical areas, mainly in the anterior maxilla and molar area (Semenoff *et al.*, 2011; Puricelli, 2009).

From these images radiographic findings of major clinical importance can be identified; the prevalence of these findings has been reported as up to 96% in different series (Aguilar *et al.*, 2009). The literature has generally focused on research on panoramic radiographs regarding the presence of maxillary sinus alterations, abnormalities of the nasal cavities, osteolytic and osteogenic lesions in the maxilla and mandible, the presence of dental retentions, the

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relationship among dental retentions and adjacent anatomical structures and the prevalence of dental and skeletal abnormalities.

The aim of this study is to report the prevalence of alterations and pathologies of the analysis of 516 digital panoramic radiographs obtained at the admission clinic of the Dentistry School, at the ENES, Unidad León.

MATERIAL AND METHOD

This retrospective study is based on findings uncovered following analysis of digital panoramic radiographs of 552 patients were included in the study. Five hundred sixteen of the digital panoramic radiographs, which were obtained with a panoramic X-ray (Orthopantomograph OP200D. Orthoceph, OC200D. Instrumentarium Dental. U.S.). We selected only those radiographs that were taken by the same teacher in charge of the dental imaging area. Thirty-six radiographs were excluded from the study because a different dentist teacher had taken them. We used a computer with a 20-inch monitor (LCD Color S2032 with resolution 1600 X 900 Hewlett Packard. U.S.) for visual analysis of the images for data collection. Only one dentist teacher integrated all the information related to alterations or pathologies recorded within a database in Excel 2010 (Microsoft Office Professional. U.S.), and performed this visual analysis and data collection. Three dentist teachers subsequently analyzed all the information collected to elucidate the results of this study.

RESULTS

Of the 516 digital radiographs that were included in the study 214 patients are male and 302 female patients. The age ranged from 6 to 77 years old, with a mean age of 25.9 years.

In the 516 radiographs that were included in the study, we found an incidence of abnormalities in the maxillary sinuses in 245 patients (47.48%) including pneumatization, thickening of the mucosa and polyps, with a frequency for male of 31.02% and 68.97% for females. The maxillary sinuses were symmetrical in 190 patients (36.82%) with a sex distribution of 42.63% in men and 68.12% in women. The asymmetry of the maxillary sinuses was present in 145 patients (28.10%), of which 36.55% occurred in men and 63.44% in women. The pneumatization of the maxillary sinus was observed in a total of 186 patients (63.67%) with a gender distribution of 30.64% in male and 69.35% in women, in men the right side pneumatization occurred in 40.35% and 59.64% in the left side, while in women the right side pneumatization occurred in 41.08% and 58.91% in the left side. The thickening of the mucosa of the maxillary sinus was present in 52 patients (21.22%). In men it occurred in 14 patients (26.92%) of which 9 were unilateral (17.30%) and 3 bilateral (5.76%), in women it was observed in 38 patients (73.07%) of which 33 were unilateral (63.46%) and 5 bilateral (9.61%). The presence of sinus polyps was found in a total of 7 patients (2.8%), one male patient (14.28%) of the right side and 6 female patients (85.71%) of which 4 were present on the right side (66.66%) and 2 on the left side (33.33%) (Table I).

Table I. Percentage of abnormal maxillary sinuses.

	Total	Men		Women	
Abnormalities	47.48	31.02		68.97	
Symmetry	36.82	42.63		68.12	
Asymmetry	28.10	36.55		63.44	
Pneumatization	63.67	30.64		69.35	
		R 40.35	L 59.64	R 41.08	L 58.91
Thickening of the mucosa	21.22	26.92		73.07	
		U 17.30	B 5.76	U 63.46	B 9.61
Polyps	2.80	14.28		85.71	
		R 100	L 0	R 66.66	L 33.33

R = right, L = left, U = unilateral, B = bilateral.

We observed a frequency of nasal cavity alterations in 357 patients (69.18%) with a sex distribution of 43.50% in men and 56.86% in women. The greatest change observed was in nasal turbinate hypertrophy with an incidence of 59.10% and with a gender distribution of 36.01% in men and 63.98% for women. In men the right turbinate hypertrophy occurred in 35 patients (46.05%), left side in 38 patients (50.00%) and bilaterally in 3 patients (3.9%). In women the right turbinate hypertrophy was present in 67 patients (49.62%), left side in 63 patients (46.66%) and bilaterally in 5 patients (3.7%). Nasal septal deviation was found in a total of 112 patients (31.37%), with a sex distribution of 47 male patients (41.96%), with an incidence of deviation to the right side in 55.31% and 44.68% to the left side and 65 patients female (58.03%) with an incidence of right deviation of 49.23% and 52.30% to the left side (Table II).

There were some structural abnormalities as maxillary asymmetry, mandibular asymmetry, mandibular basal ridge defects, structural asymmetry of the temporomandibular joint (TMJ) and the presence of foreign bodies. The frequency of maxillary asymmetry was observed in 5 patients (0.96%) of whom one was male (20%) and 4 female (80%). The mandibular asymmetry occurred in 57 patients (11.04%) with a sex distribution of 24 male patients (42.10%) and 33 female patients (57.89%). Eleven

patients had a structural defect in the mandibular basal ridge (2.13%), 4 males (36.36%) and 7 females (63.63%). A total of 154 patients had structural asymmetry of the TMJ (29.84%) with a sex distribution of 58 male patients (37.66%) and 96 female patients (62.33%). In 6 patients (1.1%) 2 male (33.33%) and 4 females (66.66%) was observed the presence of foreign bodies such as osteosynthesis material. It was also noted the type of dentition presented by patients, 23 patients had mixed dentition (4.4%) with the following distribution by sex, 39.13% in men and 60.86% in women, while 493 patients had permanent dentition (95.54%) with the following distribution by sex, 41.58% in men and 58.41% in women (Table III).

In the maxilla an incidence of 15 radiolucent lesions (2.90%) was found with a sex distribution of 4 in men (26.66%) of which 3 (75%) were found in relation to a tooth, and 11 in women (73.33%) of which 6 (54.54%) were found in relation to a tooth. We observed an overall incidence of 8 radiopaque lesions in the maxilla (1.55%) of which one occurred in men (12.5%) and 7 in women (87.5%). In the mandible 43 lesions were radiolucent (8.33%) with a sex distribution of 18 in males (41.86%) of which 61.11% were in relation to a tooth, and 25 in women (58.13) of which 64 % were in relation to a tooth. With regard to radiopaque lesions of the jaw an incidence of 49 lesions (9.49%) was found of which 18 were in males (36.73%) and 31 in women (63.26%), only a radiopaque lesion was related to a tooth and occurred in women (3.2%) (Table IV).

Total dental retentions observed in the entire sample were 1,189. In the maxilla there were a total of 463 dental retentions, of which 434 (93.73%) were third molars, 5 fourth molars (1.07%), 15 canines (3.23%) and 9 supernumeraries (1.94%). The gender distribution of the maxillary third molars was as follows: in males 151 (34.79%) which were presented on the right side in 54.96% with an incidence of relationship with the maxillary sinus of 63.85%, the left side was 45.03% with an incidence of relationship with the left maxillary sinus of 61.76%,

Table II. Percentage of abnormal nasal cavities.

	Total	Men	Women
Abnormalities	69.18	43.5	56.86
		36.01	63.98
Nasal turbinate hypertrophy	59.1	R 46.05 L 50	R 49.62 L 46.66
		B 3.9	B 3.7
Nasal septal deviation	31.37	41.96	58.03
		R 55.31 L 44.68	R 49.23 L 52.30

R = right, L = left, B = bilateral

Table III. Percentage of structural abnormalities.

	Total	Men	Women
Maxillary asymmetry	0.96	20	80
Mandibular asymmetry	11.04	42.1	57.89
Mandibular basal ridge defects	2.13	36.36	63.63
TMJ asymmetry	29.84	37.66	62.33
Foreign bodies	1.1	33.33	66.66
Mixed dentition	4.4	39.13	60.86
Permanent dentition	95.54	41.58	58.41

woman had 283 retained third molars (65.20%), 116 (40.98%) occurred on the right side with an incidence of relationship with the maxillary sinus of 61.20% and 136 occurred on the left side with an incidence of relationship with the maxillary sinus of 63.23%. The fourth molars in the maxilla were in males with an incidence of 0.43% with no difference between the sides on which they were presented; in women the fourth molars occurred in 0.64%, more frequently (66.66%) on the left side. The maxillary impacted canines were in males in 1.29%, more frequently on the right side (66.66%) than the left side (33.33%). The maxillary impacted canines were presented in women in 1.94% with a frequency of 55.55% on the right side and 44.44% on the left side. Maxillary supernumerary impacted tooth occurred in men with a frequency of 0.64% with the highest incidence on the right side (66.66%), in women occurred in 1.29% more frequently on the left side (66.66%).

In the mandible there were a total of 729 dental retentions, of which 711 (97.53%) were third molars, 2 fourth molars (0.27%), 3 canines (0.41%) and 13 supernumeraries (1.78%). The gender distribution of third molars in the mandible was as follows: in males

292 (41.06%), which were present on the right side in 45.89%, with an incidence of relationship with the right inferior alveolar nerve of 33.21%, in the left side in 54.10% with an incidence of relationship with the left inferior alveolar nerve of 38.35%. Women showed 419 retained mandibular third molars (58.93%), 181 occurred in the right side (43.19%) with an incidence of relationship with the right inferior alveolar nerve of 29.35%, and 238 on the left side (56.80%) with an incidence of relationship with the left inferior alveolar nerve of 35.56%. The fourth molars in the mandible did not occur in men, whereas in women the incidence was 0.27% with the same amount on each side. The impacted canines in the mandible were observed in males at 0.13% with the highest incidence on the left side, in women impacted canines in the mandible were observed in 0.27% in the same proportion on each side. Mandibular supernumerary impacted teeth were in males at 0.68% with a higher incidence of left side 60%, in women the incidence was of 1.09% with a higher incidence in the right side 62.5%. The total impacted canines was 18 (3.64%), of which the upper right had a higher retention rate with 9 cases (50%), upper left in 6 cases (33.33%), one case of lower left (5.55%) and two in the lower right quadrant (11.11%) (Table V).

Table IV. Percentage of radiolucent and radiopaque lesions.

Type of lesions	Maxilla			Mandible		
	Total	Men	Women	Total	Men	Women
Radiolucent	2.9	26.66	73.33	8.33	41.86	58.13
		RT 75	RT 54.54		RT 61.11	RT 64
Radiopaque	1.55	12.5	87.5	9.49	36.73	63.26
		RT 0	RT 0		RT 0	RT 3.2

RT = Related to a tooth

Table V. Percentage of dental retention.

	Total sample	Maxilla					
		Men			Women		
		Total	Right	Left	Total	Right	Left
Third molars	93.73	34.79	54.96	45.03	65.2	40.98	48.05
Third molars related to maxillary sinus		62.91	63.85	61.76	55.47	61.20	63.23
Fourth molars	1.07	0.43	50	50	0.64	33.33	66.66
Canines	3.23	1.29	66.66	33.33	1.94	55.55	44.44
Supernumeraries	1.94	0.64	66.66	33.33	1.29	33.33	66.66
		Mandible					
		Total	Right	Left	Total	Right	Left
Third molars	97.53	34.79	54.96	45.03	58.93	43.19	56.80
Third molars related to inferior alveolar nerve		71.57	33.21	38.35	64.91	29.35	35.56
Fourth molars	0.27	0	0	0	0.27	50	50
Canines	0.41	0.13	100	0	0.27	50	50
Supernumeraries	1.78	0.68	40	60	1.09	62.5	37.5

DISCUSSION

The results of this study are very similar to those reported by Aguilar *et al.*, who in a similar study in a Latin American population reported a 56% incidence of sinus abnormalities, while in our study we found an incidence of 47.48%. We also found an incidence of 357 alterations of the nasal cavities, among which we identified nasal turbinate hypertrophy and nasal septum deviation with respect to turbinate hypertrophy. The above authors reported an incidence of 52% and 43% for nasal septum deviation, while in our study we reported an incidence of 59.1% of cases with turbinate hypertrophy and 31.37% of cases with nasal septum deviation. With respect to the maxillary sinuses pneumatized, our study found that this alteration occurred mainly on the left side in both men 59.64% and women 58.91%. These authors also reported the presence of radiolucent and radiopaque 8.7% in 2.19%, but did not report the average age of the sample. Our study found a frequency of 11.24% for radiolucent lesions and 11.04% for radiopaque lesions in a sample whose mean age was 25.9 years. Bondemark and colleagues (Bondemark *et al.*, 2006) in a study conducted with a sample of 496 radiographs reported an incidence of 4.4% of opacities in the jawbone and 1% of radiolucent lesions in a sample with a mean age of 11.2 years of age.

Also in this study we found a frequency of maxillary sinus mucosal thickening of 21.22%, which is very similar to the results published by Pazera *et al.* (2011), who reported an incidence of 23.7%. In a study published by Bateman *et al.* (2003), he reported an incidence of sinus polyps of 1 to 4%, in our study we obtained an incidence of 2.8%.

We observed a frequency of 0.96% of maxillary asymmetry in the transverse direction. This result is consistent with the age characteristics of our sample because it included patients with mixed dentition and partially edentulous patients.

Harris & Clark (2008) described, in a study of 1,700 panoramic radiographs, a frequency of 1.64% of fourth molars without referral to if they were in the maxilla or in the mandible. They also reported a 3.7% incidence of supernumerary teeth. In our study we observed a frequency of fourth molars of 1.34% and an incidence of 3.72% of retained supernumerary, these results are very similar to the Harris and Clarks study. It is noteworthy that our study also reported

the gender and the side on which these dental retentions occurred.

Hameed Ullah *et al.* (2009), reported a frequency of 3.33% of impacted canines in a sample of 1,924 patients, of whom 87.67% were retained maxillary canines and 12.32% were retained mandibular canines, upper right canine presented an incidence of 51.56%, the upper left 46.87%, lower left canine 9.4% and the lower right canine 4.7%. The results reported by these authors regarding the retention of the canines are broadly in line with the results of our study. We found a frequency of 3.64% of impacted canines of which 83.33% were in the maxilla and 16.66% in the mandible, while the impacted canine that was presented more frequently was the upper right with a frequency of 50%, followed by the upper left with 33.33%, the lower left showed a frequency of 5.55% and the lower right presented a frequency of 11.11%.

Chu *et al.* (2003), published a major study of the incidence of dental retention in a sample of 7,486 panoramic radiographs. They reported an incidence of 2,115 patients with at least one tooth retention. Referring to the location of these retentions, their study reported that of 3,853 dental retentions found, the mandibular third molar had an incidence of 82.5%, while the maxillary third molar had an incidence of 15.6%, and canines had an incidence of 0.8%. In our study we recorded a total of 1,192 impacted teeth, of which 61.15% were the mandibular third molar, the 38.84% the maxillary third molar and only 1.51% were canines. The age range of the study of Chu., was very similar to our range of ages, they established that range between 17 and 89 years old, while in our study the range was between 6 and 77 years old.

All our results are proportionally related to age group and most patients who obtained radiographs for this study came to clinic requesting oral surgery service.

CONCLUSIONS

The panoramic radiograph is an excellent adjunct to the diagnosis, prognosis and development of a dental treatment plan. Due to their characteristics, it is possible to have a comprehensive view of the maxillofacial complex. A proper evaluation of the images will allow us to detect alterations or conditions that may come to pass unnoticed in the process of oral diagnosis and that can be diseases with a major impact on health.

Many of the alterations that occur in maxillofacial complex, sometimes enrolled asymptomatic, so that the imaging study is a major factor for their early detection.

The panoramic radiograph shows the condition of permeability of the nasal cavities. This information is useful in general anesthesia and nasotracheal

intubation; the pneumatization of the maxillary sinuses is of great significance for implant-supported rehabilitation of the maxilla. The asymmetries of the jaws and the asymmetry of the TMJ are significant findings in the diagnosis and treatment of dentofacial discrepancies, malocclusion, TMJ and myofunctional disorders.

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RESUMEN: El objetivo fue describir la prevalencia de alteraciones y patologías en radiografías panorámicas digitales de la clínica de la Facultad de Odontología de la Escuela Nacional de Estudios Superiores, Unidad León, desde octubre de 2011 hasta abril de 2012. Se desarrolló un estudio retrospectivo que incluyó a 516 radiografías panorámicas digitales en las que se realizó un análisis visual para informar de la prevalencia de anomalías o patologías. Los hallazgos se relacionaron con anomalía o patología del seno maxilar, cavidad nasal, hueso maxilar y mandibular, y alteraciones dentales. La radiografía panorámica debido a su versatilidad sigue siendo uno de los métodos de diagnóstico oral y maxilofacial más importantes, que nos ayuda a detectar patologías, que no siempre tienen la sintomatología y podrían causar problemas de salud.

PALABRAS CLAVE: radiografía panorámica, seno maxilar, cavidad nasal, maxilar, mandíbula.

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