

Magnitude and determinants of exodontia in South Batinah region of Oman A cross sectional study

*Rajiv Khandekar¹, Zina Fouad², Aliya M Al-Khusaibi³

حجم ومحددات قلع الأسنان في منطقة جنوب الباطنة في سلطنة عمان، دراسة عرضية

راجيف خانديكار، زينة فؤاد وعالية الخصيبي

المستخلص: الهدف: معرفة أسباب خلع الأسنان في منطقة جنوب الباطنة من خلال المترددين على عيادات الأسنان الثلاث بالمنطقة. **الطريقة:** تم إجراء هذه الدراسة على عينة مكونة من 8963 مريض تمثل حالات قلع الأسنان للمترددين على عيادات الأسنان بالمنطقة على مدى 12 أسبوع في عام 2000م. تم تجميع المعلومات المطلوبة من ملفات هؤلاء المرضى المترددين على عيادات الأسنان. و استخدام التعريفات المتعلقة بقلع الأسنان، والاعتماد على تعداد السكان لعام 2000م للمنطقة كمرجع لمعرفة تعداد السكان بالمنطقة ونسب العمر والجنس. وكانت المعلومات الإحصائية موثقة بنسبة 95%. **النتائج:** كانت نسبة قلع الأسنان 16.67 لكل 1000 نسمة من السكان (CI_{95%} 16.52-16.82) ونسبة قلع الأسنان في الذكور (11.56-11.73) وفي الإناث 40.04 (CI_{95%} 39.73, 40.34). وكانت النسبة للفئة العمرية أكبر من 12 سنة أعلى منها من الفئة العمرية أقل من 12 سنة. ومعدل الإصابة يظهر بأشكال مختلفة. **الخلاصة:** كان معدل قلع الأسنان مرتفعاً في مناطق الدراسة وبالخاصة بين الإناث أكبر من 12 سنة والمناطق الساحلية في جنوب الباطنة. وبناء على ذلك تم تقييم خدمات صحة الفم والإقتراح بتحسين خدماتها. مفاتيح الكلمات: قلع الأسنان؛ تسوس الأسنان، برنامج صحة الفم.

ABSTRACT. Objectives: To estimate the magnitude, determinants and causes of exodontia presented at all the three dental units of South Batinah region of Oman. **Methods:** This is a cross sectional study of 8,963 samples representing dental cases reported at the three dental units for 12 weeks in year 2000. The information on patients undergoing exodontia and its indications were collected from their case files. Standard definitions were used to categorise causes of exodontia. Mid 2000 population was used as reference for calculating rates. Age-sex standardisation and 95% confidence interval of the exodontia rates were calculated for statistical validation. **Results:** The annual exodontia rate was 16.67 per 1,000 population (CI_{95%} 16.52, 16.82). The rate in males was 11.56 (CI_{95%} 11.40, 11.73) and in females, 40.04 (CI_{95%} 39.73, 40.34). The rate in the 12+ age group was significantly higher than that in the 0-12 age group. The rates showed geographic differences. **Conclusions:** The exodontia rates were high in the study area. Exodontia rates were significantly higher in females, persons older than 12 years, and those living in the coastal areas of South Batinah. Based on the exodontia rates, the impact on the oral health services was reviewed and recommendations for improving the dental care were proposed.

Key words: exodontia, dental caries, oral health programme, Oman

DENTAL CARE IS ONE OF THE IMPORTANT health initiatives in Oman.¹ Rapid economic development in the Middle East has resulted in changes in the dietary pattern, especially among children. Large arid area of Oman has water supply either through pipelines from desalination plants or from wells, using tankers. The fluorine content of water supplied to the population varies considerably in different areas. Personal hygiene habits of the population are changing but changing attitudes would take long time. Thus the risk of dental caries seems to be high in Oman.

The Ministry of Health has prioritized oral health in the national five year health plan. The problem of dental

caries is addressed through the oral and dental health program and it has adopted the strategies of early detection of dental caries and prevention of dental caries through prophylactic intervention, increasing awareness for oral hygiene and promoting water fluoridation by regional authorities. The survey conducted to estimate the dental status of 6 year old school children reported DMF rate of 4.61.² The rate in 12 to 13 year-olds in 2000 was 1.53%.³ Thus dental caries seems to be a major public health problem in school children of Oman. Qualified dentists at dental clinics and mobile dental units provide dental care to the population in all health regions.

South Batinah region has both coastal and mountainous

¹Specific Diseases Control Programme, DSDC, DGHA, Ministry of Health, P.O.Box 393, Muscat-113, Sultanate of Oman, ²Dental Department, Rustaq Hospital, South Batinah Region, Ministry of Health, Sultanate of Oman, ³Oral Health Program, Ministry of Health, Sultanate of Oman.

terrain. Three static dental units at the health institutions at Rustaq, Musanna and Barka and one mobile unit cater to nearly 205,000 Omani population.⁴

Exodontia (dental extraction) is an indicator of the dental caries problem and status of oral health of a population. Limited information is available in the literature on the magnitude and determinants of exodontia in Oman and other Middle Eastern countries. As this information is crucial for improving the dental services and determining the risk factors of this problem, a study was undertaken in South Batinah region to review exodontia cases seen at three dental units. Based on the results of the study recommendations to improve dental services in the regions were proposed.

METHOD

This was a cross sectional type of descriptive study. Mid-2000 population of South Batinah region was the reference population.⁴ The cases of patients visiting the dental units of Rustaq Hospital, Barka and Musanna health centres from 1st April 2000 to 21st June 2000 (12 weeks) and had tooth extraction were included in the study. Seven dentists comprised the field staff. A detailed dental examination and recording of the findings as present in the case file was undertaken as per the standard operating procedures.⁵ Details such as gender, age and causes of dental extraction were also collected.

Where a patient had teeth with completely missing crown due to destruction by dental caries with remaining root embedded in the alveolar bone, the condition was grouped under "remaining roots indicated for extraction". Cases of caries teeth unfit for any type of conservation, were grouped under 'gross dental caries with no dental salvation.' Patients were grouped into 'deciduous teeth problem' if (a) the deciduous teeth were mobile and near shedding and parent requested for their removal, (b) deciduous teeth were over-retained and permanent successors had appeared in mal-positions, or (c) deciduous teeth needed extraction before shedding time to avoid overcrowding of the erupting permanent teeth. The group for 'prosthetic treatment' included cases which had tooth extraction to give space for orthodontic treatment, tooth with chronic periodontitis and tooth removed for prosthetic treatment. The cases undergoing tooth extraction of posterior multi rooted teeth that were badly destructed and could not be restored by endodontic treatment were grouped under exodontias for 'exposed teeth'. Those with history of trauma were placed under 'exodontia following trauma.'

Quality assurance procedures, such as the use of standard definitions, pre tested form for collecting data,

and mode of diagnosis and treatment as per the standard operating procedure stipulated in oral health manual, were performed in this study.

The data were collected using standardised form and computed using pre-tested format on Microsoft Excel software. Two entries were performed and matched to correct discrepancies. Double entry system was utilized for correct entry of the data. The frequency and percentage proportion of the cases of exodontia per cause were calculated. For statistical validation, the results were adjusted using indirect standardization method. The population proportion by age group, gender and wilayat (mid 2000 population) were referred for this purpose. The population proportions by age group, gender and wilayat (mid 2000 population) were referred for this purpose² by age, gender and location. By using population preparations of region as gold standard, the results in subgroups were compared. 95% confidence interval (CI_{95%}) was calculated for the important results. Based on the outcome of 12 weeks, annual extraction rates were calculated by using factor 52.5/12. The participants gave their verbal consent for tooth extraction as per the protocol of the Ministry of Health. Consent of the regional and hospital authorities was obtained. The feedback of the study was provided with the recommendations for improving dental care.

The annual dental screening for 1st primary students is undertaken between October and May. Therefore students identified with problem and referred for the dental care could constitute a larger proportion of the cases requiring exodontia among deciduous teeth.

RESULTS

The characteristics of the population of the South Batinah region and of the examined sample are given in Table 1. Proportion of the study population and the examined sample differed markedly suggesting the need for standardisation before generalising the outcome to the population.

THE EXODONTIA AND RISK FACTORS. The frequency of exodontia cases crude and adjusted rates per 1000 population and their 95% CI were calculated for different variants [Table 2]. The exodontia rates suggested need for dental extraction in 16 out of 1,000 population. Females, those above 12 years and those residing in the costal areas of Barka and Musanna wilayats had significantly higher rates of exodontia.

CAUSES OF EXODONTIA. The cases of exodontia were grouped according to the causes and their proportion [Table 3]. Nearly half of the dental extractions were due to the caries patients who had come in advanced stages

where salvation was not possible. The proportion of exodontia due to other causes such as periodontitis, secondary caries, trauma, exposed pulp and deciduous teeth was low and statistically not significant.

Table 1. Profile of the study population and examined sample (South Batinah Dental Study 2000)

Epidemiological sub-groups	Study population (Mid 2000)		Examined sample (for 12 weeks)		
	#	%	#	%	
Gender	Male	142,185	58.4	3,668	40.9
	Female	101,408	41.6	5,295	59.1
Age-group	0-12	72,461	29.7	2,184	24.4
	13+	171,132	70.3	6,779	75.6
Area	Barka	76,146	31.3	2,676	29.9
	Musanna	56,195	23.1	2,298	25.6
	Rustaq	111,252	45.7	3,989	44.5
Total		243,593	100.0	8,963	100.0

Table 2. Rate of exodontia by variants (South Batinah Dental Study 2000)

		Frequency	Crude rate	Adj rate	CI 95%
Gender	Male	1,703	11.98	11.56	11.40, 11.73
	Female	2,491	24.56	40.04	39.73, 40.34
Age group	<12	1,319	18.20	17.34	17.06, 17.62
	13+	2,875	16.80	19.82	19.63, 20.01
Institution	Barka EHC	1,098	14.42	16.25	15.99, 16.51
	Musanna EHC	903	16.07	21.03	20.69, 21.36
	Rustaq Hospital	2,193	19.71	14.75	14.54, 14.96
Total		4,194	17.22	16.67	16.52, 16.82

DISCUSSION

The study addressed the important issue of exodontia. Limited information is available in Oman on the magnitude of exodontia, especially in adult population. The result of the present study could be useful to reorganise the oral health services in the study area.

The sample covered all the cases of patients visiting dental units of South Batinah. As dental services are offered free of cost in Oman, it is likely that the study covered majority of the symptomatic cases of dental

problem. Those without symptoms may not have visited the health institution and some with symptoms may have visited private dental clinics. However, costly private dental services for dental extraction purpose constitute less than 10% of total cases of exodontia, as was revealed by personal communication with the dentists of the region. Since areas of Barka and Musanna had overlapping catchment area, some of the dental cases might have visited the dental units of neighbouring regions. However, since similar patients from the neighbouring Suwaiq Wilayat are known to visit Musanna Extended Health Centre and Rustaq Hospital, the number of cross-regional cases is likely to be constant. Private clinics might have been visited by the comparatively affluent, mainly for prosthetic treatment, since these services are not provided in the regional Ministry of Health institutions. Thus the study results could be generalised to the entire population, with caution.

Table 3. Causes of exodontia (South Batinah Dental Study 2000)

Gross dental caries with no salvation possible	2,176	51.9%
Deciduous teeth with problem	837	20.0%
Remaining teeth to be extracted	590	14.1%
For prosthetic treatment	431	10.3%
For exposed teeth	114	2.7%
Secondary caries	43	1.0%
Secondary to trauma	3	0.1%
Total	4,194	100.0%

With the inclusion of the data of all the cases visiting the three dental units of the region for 12 weeks of the study period and with such a large sample, the rates of the exodontia are likely to be true values and less likely to be observation by chance. Since the proportion of the study population and examined population differed, standardisation was carried out. This also enabled to minimize the effects of age, gender, geographic distribution and other unknown confounders on the exodontia rates. The quality assurance procedures minimized the observation and misclassification bias. The hospital records were used, hence recall bias is less likely. Since the participating dentists were aware of the study, observer bias, especially for exodontias, could be possible. The annual rate of dental extraction in region during study period closely matched the rate during the other months of the same year.² The study in 1993 conducted to determine the main demand of dental patients showed large proportion of clinics having patients attending 27 private clinics with first choice of extraction.⁶ Therefore

an overestimation of exodontia due to observer's bias, even if it exists, would be marginal, and is unlikely to have given spurious results.

The details of exodontia in relation to the type of teeth were not collected in this study. Therefore causes in different groups of teeth could not be assessed.

Extraction rates per attendance of the dental clinic have been reported in different studies.^{8,9,11} Among highly educated and health conscious population, such hospital based rates might reflect the situation in overall population. But such calculation would not give true rates in developing countries where access to the dental services is limited and dental care awareness in the population is low. The exodontia rates in this study in relation to the dental consultations ranged from 40% to 50%. In view of over utilization of health services in Oman,⁷ the possibility of multiple visits for different episodes, such denominator may be misleading. Therefore, the rates of exodontia in relation to the population were calculated in this study.

Dental caries and its complications constituted more than 95% of the exodontia cases among the study population. More than half of them consulted the dentists at a stage when salvation of the caries tooth was not possible. This is a matter of concern. Screening of high risk population, implementing preventive measures and promotion of health education for early and periodic dental check ups are the strategies that need to be vigorously implemented.

The study in USA showed that in spite of improved paediatric oral health, dental caries and its sequel remained the most common reason for extraction of primary teeth.⁸ Developed countries such as the UK^{9,10} and Norway¹¹ also showed similar trends of high proportion of dental caries as cause for dental extractions.

Gender difference of tooth extraction was not found in USA.⁸ But females were at more risk for tooth loss in Kenya compared to male and the trend was observed of more male having exodontia due to periodontal diseases.¹² In Oman, male-female population ratio is 103:100.² The health services are easily accessible at nominal cost of less than half dollar. In this situation, the gender difference observed for high dental extraction among females needs further study to confirm the findings and determine the underlying causes of the gender variation.

In this study, 20% of the exodontia was for deciduous teeth of under 12-year-olds. However, detailed age grouping was not carried out in this study. The causes of exodontia by age group, mainly focusing the geriatric age groups, therefore could not be studied.

A national study with sound epidemiological methodology and adding the information on tooth involved should be undertaken.

The results suggest that 17 persons per 1,000 population underwent dental extraction. Based on this rate, the resources for providing dental services could be planned. Currently seven dentists in three dental units provide care for exodontia. During the study period, each dentist attended about ten cases of exodontia in the seven hours of a working day. Estimating an average 20 minutes per procedure per patient, each dentist would be occupied for 3½ hours on exodontia services. This may compromise their other work of screening, counselling and specialised orthodontic work.

Due to a lack of skilled manpower to undertake endodontic treatment at the regional centres, caries patients requiring conservative treatment have to be referred to a tertiary dental care unit at Muscat. If such conservative treatment requires multiple visits, patients usually refuse and do not comply for the complete treatment. In such situation, the dentist might opt for dental extraction, which might also contribute to increase the rate of exodontias. Further studies to determine the advice to dental caries patients prior to exodontias would help to understand the magnitude of additional exodontias than those actually needed.

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REFERENCES

1. **Ministry of Health.** Specific disease control program—dental caries. *5th Five Year Health Plan of the Ministry of Health, Sultanate of Oman.* 1995, pp: 67–78
2. **Ministry of Health, World Health Organization.** National DMF Survey of 1st primary school children in Oman.
3. **Ministry of Health, World Health Organization.** National DMF Survey of 1st Preparatory School Children in Oman.
4. **Ministry of Health.** *Annual Health Report 2000. Muscat, Oman.* pp: 1-1, 9.
5. **Oral Health Care Manual 1st edition, Ministry of Health, Sultanate of Oman, Golden Printers, Muscat, Oman 1998.**
6. **Hassan F.** Evaluation of dental care at private dental clinic in Oman. 1993 (*Unpublished document of the Ministry of Health, Sultanate of Oman*)
7. **Tjam FS.** A report on referral activities in healthcare sector of

- Oman World Health Organization (unpublished), 1996, 8–9.
8. **Alsheneifi T, Hughes CV.** Reasons for dental extractions in children. *Pediatr Dent*, 2001, **23**, 109–112.
 9. **Agerholm D.** Reasons for extraction by dental practitioners in England and Wales: a comparison with 1986 and variations between regions. *J Dent*, 2001, **4**, 237–241.
 10. **Mc Caul LK, Jenkins WM, Kay EJ.** The reasons for the extraction of various tooth types in Scotland: a 15 year followup. *J Dent*, 2001, **29**, 401–407.
 11. **Trovik TA, Klock KS, Haugejorden O.** Trends in reasons for tooth extraction in Norway from 1968 to 1998. *Acta Odontol Scand*, 2000, **58**, 89–96.
 12. **Manji F, Baelum V, Fejeskov O.** Tooth mortality in an adult rural population in Kenya. *J Dent Res*, 1988, **67**, 496–500.