ORIGINAL ARTICLE

The Pattern of Maxillary Cleft Alveolus in Patients from Khyber College of Dentistry, Peshawar, Pakistan: A Cross-Sectional Study

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ABSTRACT

Objective: This study aimed to determine the pattern of a maxillary cleft alveolus in patients from Khyber College of Dentistry Peshawar, Pakistan.

Study Design: Cross-sectional study.

Place and Duration of Study: The study was conducted at the Department of Oral and Maxillofacial Surgery, Iqra National University Peshawar, Pakistan from 2nd February 2022 to 2nd July 2022.

Methods: A total of 98 paediatric patients aged from birth to 16 years were chosen using a consecutive non-probability selection method. Thorough clinical and radiographic investigations were conducted to verify the diagnosis and determine the specific characteristics of the cleft alveolus. The data were examined using R studio, utilising descriptive statistics, *chi-square* tests, *t*-tests, and ANOVA.

Results: The average age of patients was 0.31 ± 0.32 years. The gender distribution was about equal, with a male-to-female ratio of 1.04:1. The occurrence of unilateral cleft alveolus was considerably higher (83.67%) than that of bilateral cleft alveolus (16.33%). No significant statistical connections were discovered between age, gender, and cleft type ($P > 0.05$). The *t*-test and ANOVA analyses revealed statistically significant variations in average ages between unilateral and bilateral cleft types, albeit clinically negligible.

Conclusion: The study highlighted the prevalence of clefts on the left side of the face, emphasising the importance of this information for planning surgeries and allocating resources. Although there are no significant demographic connections, the results affirm the need for early intervention and a multidisciplinary approach to enhance patient outcomes.

Keywords: *Cleft Lip, Cleft Palate, Craniofacial Abnormalities.*

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Introduction

Oral clefts, which include cleft lip and palate, are among the most common birth defects worldwide, occurring in approximately 1 to 2.2 instances per 1000 live births.[1] Clefts can affect the lip, alveolar ridge, and palate, resulting in facial abnormalities that affect appearance. They can also cause functional problems, such as issues with feeding and communication, as well as psychological illnesses.[2,3] Children with a cleft are more likely to have recurring ear infections because of problems with the Eustachian tube and communication between the mouth and the sinus.[4,5] This can result in milk reflux into the nose and ear, which may cause long-term hearing problems. Furthermore, dental abnormalities concerning teeth morphology, composition, quantity, and alignment are frequently observed, particularly in teeth neighbouring the fissure. People with oral clefts usually need thorough treatment from a team of experts in various fields, starting from birth and continuing throughout maturity.[6]

Multiple research findings have provided significant information regarding the frequency and attributes of mouth clefts. Lithovius et al. conducted a study in

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two hospitals in Uganda and found that 82% of patients had left-sided clefts, whereas 18% had right-sided clefts.[7] Wilson et al. found that left-sided oro-facial clefts occurred twice as often as right-sided clefts and six times more often than bilateral clefts. These findings emphasise the need to comprehend the distinct patterns of a cleft alveolus in various populations to guide surgical and therapeutic approaches.[8-11]

Hereditary and environmental factors influence the development of mouth clefts. Genetic predisposition is a major factor, as multiple studies have identified particular gene variants linked to a higher risk.[12] Maternal smoking, alcohol intake, and nutritional inadequacies during pregnancy are environmental factors that also have a role in the occurrence of mouth clefts.[3] An investigation conducted by Wehby and Murray (2010) brought attention to the correlation between maternal smoking and heightened susceptibility to cleft lip and palate.[13,14]

Managing oral clefts necessitates a collaborative endeavour from a multidisciplinary group comprising plastic surgeons, orthodontists, prosthodontists, speech therapists, and psychologists.[15] Prompt surgical surgeries is essential to close the cleft and reinstate normal function. Research has indicated that promptly fixing the cleft lip during the initial months of a baby's life greatly enhances their ability to feed and speak well. Following surgeries to correct the cleft palate and any related dental abnormalities, subsequent procedures are usually carried out in a step-by-step manner, customized to meet the specific requirements of each patient.[16]

Although oral clefts are common worldwide, there is a lack of local data on cleft alveolus' precise patterns and characteristics. Comprehending these patterns is crucial for directing surgical planning and maximising therapeutic results. The objective of this study is to collect data on the occurrence of cleft alveolus in the local population. This data may then be compared to worldwide studies to improve our knowledge of this condition.[17] By determining the frequency of unilateral (left or right) and bilateral clefts, we may offer surgeons significant data to choose the most suitable grafting strategies for alveolar reconstruction. Moreover, this study will aid orthodontists and prosthodontists in customising their treatment approaches to address the distinct requirements of individuals with cleft conditions.

Oral clefts are a major worldwide health issue that requires a thorough and interdisciplinary therapeutic approach. This study aims to enhance the existing understanding of treatment techniques for individuals affected by cleft alveoli by collecting local data on its patterns. The discoveries will assist in the strategic preparation for surgery and improve the general standard of living for those with oral clefts, guaranteeing that they receive the most efficient and tailored treatment.

Methods

The cross-sectional study was conducted at the Department of Oral and Maxillofacial Surgery, Iqra National University Peshawar, Pakistan from 2nd February 2022 to 2nd July 2022 after taking approval from the Ethical Review Committee of the university on dated: 1st February 2022 vide letter ref no: INU/AHS/1095-2022. Before including any patients in the study, the patient attendants provided verbally informed permission.

The study included patients of both genders with cleft alveolus aged up to 16 years from birth while excluding patients with facial clefts or syndromic conditions. A consecutive non-probability sampling procedure determined 98 patients who met the inclusion criteria. A thorough clinical and radiographic examination was performed to confirm the diagnosis and define the type of cleft alveolus. This examination was carried out by maxillofacial surgeon and/or orthodontist. Clefts were found to be unilateral (right or left) or bilateral.

Demographic characteristics such as gender, and age and the kind and pattern of cleft alveolus were thoroughly collected and documented using a self-designed questionnaire. The data was analysed using R studio version 4.4.2. Descriptive statistics were used to obtain frequencies and percentages for categorical variables (such as gender and kind of cleft alveolus) and mean and standard deviation for continuous variables (such as age). The impact of age and gender on cleft alveolus was investigated. After stratification, the *chi-square* test was used to evaluate the association between categorical variables, with a significance level of $P < 0.05$. *t*-tests

and ANOVA were used to compare means between groups i.e., unilateral (right or left) or bilateral.

Results

The average age of the patients in the study is 0.31±0.32 years. This implies that most patients are relatively young (0.10 to 1.80 years). The gender distribution is approximately equal, with a male-to-female ratio of around 1.04:1. The higher occurrence of unilateral cleft alveolus than bilateral cleft alveolus informs doctors and surgeons on treatment planning and resource allocation, as shown in table-1 and figure.1.

Table-1: Demographic details of the participants

Variable	Frequency (%)	Mean ± SD
Age (years)	98 (100%)	0.31± 0.32
Male	50 (51.02%)	-
Female	48 (48.98%)	-
Unilateral Cleft Alveolus	82 (83.67%)	-
Bilateral Cleft Alveolus	16 (16.33%)	-

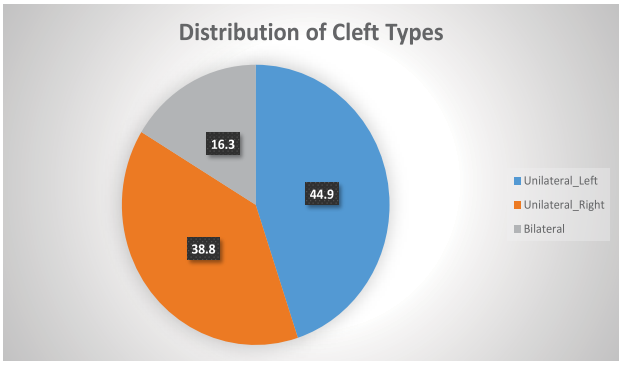

Fig.1: Distribution of Cleft Types: The pie chart exhibits the proportions of various cleft kinds among the patients.

The *chi-square* tests for age and gender with cleft alveolus show no statistically significant association between the variables. This suggests that the patient's age (p=0.109, X^2=5.74) or gender (P=0.465, X^2=1.01) does not significantly impact whether they have a unilateral or bilateral cleft alveolus. The cross-tabulation shows how cleft alveolus types vary by age and gender. Most individuals with cleft alveolus are under one year old, and unilateral cleft alveolus is more common than bilateral in both age categories. Similarly, both genders have a higher risk of unilateral cleft alveolus than bilateral cleft alveolus. These findings indicate that cleft alveolus is common in young patients of both genders, whereas the kind of cleft (unilateral or bilateral) is not significantly associated with age or gender. This information is critical for clinicians in identifying the demographics of cleft alveolus and developing effective treatment techniques, as shown in table-2.

Table-2: Association of age and gender with cleft alveolus

Variable	Detail	Unilateral	Bilateral	X^2	df	*P*-Value
Age Group	≤ 1 year	81	14	5.74	1	0.109
	> 1 year	1	2			
Gender Wise	Male	40	10	1.01	1	0.465
	Female	42	6			

The *t*-test results show a statistically significant difference in mean ages between patients with unilateral (P=0.001, t=-0.11) and bilateral cleft (P=0.001, t=-0.11) alveolus. However, because the ages of both groups are approximately equal, the *t*-statistics are relatively high, resulting in a significant precision loss in the calculation. The average age of patients with unilateral cleft alveolus is 0.31±0.32, whereas that of those with bilateral cleft alveolus is 0.32±0.32. Despite the statistical significance, the mean age difference between the two groups is small (0.01 years), as shown in table-3.

The ANOVA results show a statistically significant difference in mean ages between patients with unilateral left (P=0.001, f=0.012), unilateral right (P=0.001, f=0.012), and bilateral cleft (P=0.001, f=0.012) alveolus. However, because the ages in both groups are almost identical, the F-statistics are exceptionally high, which may result in a loss of computation precision. The average age of patients with unilateral left cleft alveolus is 0.31 years, whereas those with unilateral right and bilateral cleft alveolus are 0.32 years old. Despite the statistical significance, the difference in mean ages between

Table-3: Shows an age-wise comparison of the cleft alveolus among all participants

Group	n	Mean Age	SD	*t*	df	*P*-value
Unilateral Cleft Alveolus	82	0.31	0.32	-0.11	21.27	0.001
Bilateral Cleft Alveolus	16	0.32	0.32	-0.11	21.27	0.001

Table-4: ANOVA for Age Comparison among Unilateral Left, Unilateral Right, and Bilateral Cleft Alveolus

Group	n	Mean Age	SD	F statistics	df	*P*-value
Unilateral Left Cleft Alveolus	44	0.31	0.32		2	0.001
Unilateral Right Cleft Alveolus	38	0.32	0.32	0.012	2	0.001
Bilateral Cleft Alveolus	16	0.32	0.32		2	0.001

the groups is negligible (0.01 years). This shows a considerable difference but may not be clinically relevant given the tiny age difference, as shown in table-4.

Discussion

Cleft lip and palate (CLP) are the most common congenital facial disorders, with rates ranging from 1 to 1.82 per 1000 births. A combination of genetic and environmental causes CLP.[18] Genetic predispositions can considerably enhance risk, as evidenced by multiple studies identifying specific gene variants associated with CLP. Environmental factors like maternal smoking, alcohol usage, and nutritional inadequacies during pregnancy all play an important influence. A study conducted by Wehby and Murray et al. identified an association between maternal smoking and an increased risk of CLP.[18] In contrast, Mossey et al. stressed the relevance of folic acid supplementation in lowering the incidence of congenital anomalies.[19]

In our study, we revealed that unilateral left-side cleft alveolus was the most common kind, occurring in 44 (44.90%) patients, followed by unilateral right-side cleft alveolus in 38 (38.78%) patients, and bilateral cleft alveolus in 16 (16.33%) individuals. This finding is consistent with Chu Yu et al.'s observations, which found a higher proportion of left-sided clefts than right-sided or bilateral clefts.[20,21]

The higher occurrence of unilateral left-side clefts could be explained by embryological development. The two palatal shelves are practically vertical during the seventh week of gestation.[22]

Nahas et al. and Carrol et al. determined that cleft lip and alveolus incidence was 12.97%. Among CL/A patients, 41.66% had right-sided clefts, 43.75% had left-sided clefts, and 14.5% had bilateral clefts, indicating a relatively equal distribution of right—and left-sided clefts but a decreased prevalence of bilateral ones.[23,24] These findings imply that when cleft involvement progresses from the main to the secondary palate, the Class III relationship and hyper divergent pattern become more prevalent.[25]

Our study observed that the mean age of the patients was 0.31 ± 0.32 years, indicating a young age range of 0.10 to 1.80 years. The gender distribution was reasonably balanced, with a male-to-female ratio of around 1.04:1. This distribution is consistent with prior research that found a higher incidence of clefts in males.

The *chi-square* tests for age and gender with cleft alveolus revealed no statistically significant associations between these factors, implying that age or gender has no significant impact on the risk of having unilateral or bilateral cleft alveolus. This conclusion is important for clinicians because it shows that demographic factors may not be as crucial in presenting cleft types, allowing for a more consistent approach to treatment planning regardless of these variables. Comparing this study's findings with those of Bhoujhar et al., we observed an association between gender and cleft type. This does not support our conclusion that gender does not play a major role in cleft appearance.[26] Nabavizadeh et al. reported no significant gender differences in the prevalence of cleft lip and palate, which supports our findings.[27] Saied et al. found substantial relationships between maternal smoking and cleft types but no significant gender differences, which supports our findings and emphasises the relevance of environmental factors over demographic ones.[28]

The t-test showed a statistically significant difference in mean ages between patients with unilateral and

bilateral cleft alveolus. However, the practical difference in mean ages between the two groups was small (0.01 years), implying that a substantial difference may not be clinically important. Similarly, ANOVA results revealed a statistically significant difference in mean ages between patients with unilateral left, unilateral right, and bilateral cleft alveolus. Despite the statistical significance, the small age difference shows that age may not be the most critical factor in predicting the type of cleft alveolus.

Our results are consistent with those of Kelly et al. who discovered significant but clinically insignificant variations in mean age between cleft patients and controls.[29] Our study's results revealed a substantial difference in mean ages between cleft types, consistent with findings by Vanderas et al. and Menezes et al., which reported significant age disparities among cleft forms with small practical differences. Seo et al. employed ANOVA to examine skeletal correlations in cleft patients and found significant changes with little clinical implications, like our findings.[30]

There are several limitations of this study. Selection bias might be introduced by using a successive non-probability sampling approach, which could restrict how broadly the results can be applied. The statistical ability to identify noteworthy correlations between factors, including age, gender, and cleft kinds, could be diminished due to the limited sample size of 98 individuals. Finally, the study's absence of long-term follow-up data makes it impossible to evaluate the clinical results of various cleft forms and the therapies used to treat them over time.

Conclusion

In conclusion, our study demonstrates the high prevalence and distribution of cleft alveolus among young patients, highlighting the necessity of early diagnosis and accuracy. The prevalence of unilateral, left-sided clefts emphasizes the importance of tailored surgical methods and budget allocation. Despite the lack of substantial association between demographic characteristics such as age and gender and cleft kinds, our findings help doctors plan efficient treatment techniques. This study aims to improve the quality of treatment and outcomes for patients with oral clefts by adding local data to the already available knowledge body. The joint efforts of a multidisciplinary team are critical in addressing these individuals' complex demands, ensuring comprehensive and personalized treatment from infancy to adulthood.

Future Recommendation

Patterns of cleft alveolus can help the surgeon determine the type and size of a graft if needed. A multidisciplinary approach should be followed, which includes a paediatrician, a surgeon experienced in cleft management, a speech pathologist, a pediatric otolaryngologist, a well-versed orthodontist, a pediatric dentist, an audiologist, a geneticist, a prosthodontist, an ophthalmologist, a clinical psychologist and/or psychiatrist, a physical anthropologist, a social worker, and a nurse experienced in cleft problem.

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Conflict of Interest: The authors declare no conflict of interest.

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Authors Contribution

HA: Idea conception, study designing, data analysis, results and interpretation, manuscript writing and proofreading

MG: Idea conception, data collection, data analysis, results and interpretation, manuscript writing and proofreading

MG: Idea conception, study designing, data analysis, results and interpretation, manuscript writing and proofreading

MJU: Idea conception, data collection, data analysis, results and interpretation, manuscript writing and proofreading

NK: Idea conception, study designing, data analysis, results and interpretation, manuscript writing and proofreading