



## Clinical Study on the Dental Abnormalities of Number and Morphology in Cleft Alveolus Patients

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### ABSTRACT

## 치조열 환자에서 치아의 선천결손과 형태이상에 관한 연구

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구순구개열은 선천성 악안면 기형중에서 발생률이 가장 높은 질환이며 특히 동양인에게 높은 빈도로 발생된다. 그리고 순구개열에서는 파열부 조직의 선천적 상실과 파열부 봉합 수술 후 형성된 반흔에 의한 상악골의 열성장과 상악궁의 협착, 코의 형태 이상, 등과 함께 치아의 수, 크기와 형태 및 맹출 이상도 높은 빈도로 동반된다.

선천성 치아 발육 이상이 구순열 또는 구개열 가진 환자에게서 종종 보고되고 있다. 이런 치아 이상은 과잉치, 결손치, 크기, 형태, 맹출시기, 법랑질 광화 등의 많은 특징을 포함한다.

이번 연구의 목적은 다음과 같다.

1. 구순열 또는 구개열을 가진 환자의 선천성 치아 결손 발병률을 결정하여 정상인과 비교하는 것이다.
2. 상하악에서 파열이 있는 부위와 없는 부위의 제2소구치 결손가능성을 비교 하는 것이다.

구강악안면외과에서 구순구개열로 진단한 환자 중 2005년 1월 ~ 2009년 8월까지 전북대학교 구강악안면외과에서 치조열부위 자가골이식수술을 받은 32명의 환자로 초진시의 교정 chart, 구강악안면외과 chart, x-ray(파노라마, 치근단사진, 교합사진(상악), 석고 모델, 구강내·외 임상사진을 사용하여 순구개열군 별로 매복치, 과잉치, 결손치, 왜소치의 유무와 위치를 조사하여 다음과 같은 결론을 얻었다.

1. 결손치는 비교적 높은 발생빈도(53.1%)를 보였으며, 치아별 발생빈도는 상악 측절치와 상악 제2소구치, 하악 제2소구치 순이었다. 구순구개열군이 구순치조열군에 비해 발생률이 높게 나타났다. 그리고 구순구개열군 내에서 양측성이 편측성에 비해 결손치의 발생률이 높게 나타났다.
2. 왜소치는 71.6%에서 발견되었으며, 치아별 발생빈도는 상악측절치에서 가장 많았다. 구순치조열군이 구순구개열군에 비해 발생률이 높게 나타났다.
3. 치조열을 가진 환자에 있어 상/하악간 제2소구치의 선천적 결손에 유의한 차이가 있었다.
4. 구순구개열이 인접한 상악측절치의 발생중인 미성숙 조직에 영향을 미치며 파열부위와 좀 더 떨어져 있는 상악 제2소구치에도 일정한 영향을 미침을 이번 연구를 통해 다시 확인할 수 있었다.

**Key words:** 치조열, 결손치, 왜소치

## I. INTRODUCTION

Clefts are caused by the failure of fusion between the medial nasal process and the maxillary process, or between the palatal processes. These failures are the result of genetic and environmental factors. In South Korea, it occurs in approximately 1 of 554 live birth. The incidence of CP (cleft palate) appears at the most among cleft types; CL (cleft lip) and CLP (cleft lip and palate) follow after<sup>1)</sup>. For Japanese, it is around 2.06 of 1,000 persons and CL of 32.7%, CLP of 46.1%, and CP only of 21.2% were found<sup>2)</sup>.

On the other hand, dental abnormalities such as hypodontia, malformation, and abnormal eruption pattern occur frequently in cleft patients<sup>3)</sup>. The current surgical approach to recover the cleft alveolus is autograft on alveolar process and induction of normal tooth eruption.

From the many researches interested in frequency and factors affecting dental abnormalities in CLP, patients involved with family history or certain syndrome, such as Van der Woude syndrome, showed more abnormalities than other CLP patients<sup>4)</sup>. And upper lateral incisor is the most susceptible to injury in the area of cleft in both deciduous and permanent dentitions.

Maxillary deciduous lateral incisor around cleft area is mostly placed mesial side to the cleft. However, when succeeded to permanent lateral incisor its position migrates to distal side for the cleft. Abnormal size of mesiodistal

and buccolingual length of tooth was also observed and it is proportional to the severity of cleft<sup>5)</sup>.

For the complete recovery from cleft alveolus, bone bridge formation and induction for normal tooth eruption are significant. However, the exact reports for dental abnormalities on morphology, number and eruption associated with cleft alveolus patient living in Korea, are insufficient yet.

In this clinical study, among cleft alveolus patients who have visited our hospital, distribution by the type of cleft classification, frequency of missing tooth and abnormal shape were observed and compared to those of normal persons. And also, possibilities of second premolar missing will be compared between cleft area and healthy part in maxilla and mandible.

## II. MATERIAL AND METHODS

### 1. Material

The patients were selected from the file at the Department of Oral & Maxillofacial Surgery, School of Dentistry, Chonbuk National University. Alveolar bone graft was performed at our OMFS, from January 2005 to August 2009.

Total number of cleft patient records used in this study was n=32, 21 males and 11 females ranging between 8 and 15 years of age (mean age, 9.7 years)

**Table 1.** Sexual distribution of the cleft type and side

Cleft type	Right		Left		Bilateral		Total
	M	F	M	F	M	F	
Cleft lip and alveolus	0	0	0	3	0	0	3
Cleft lip and palate	4	2	8	6	9	0	29
Total	4	2	8	9	9	0	32

## 2. Survey Contents

Below data were collected from the patient record.

### 1) Distribution of the cleft type and side

By the degree and type of abnormalities, the patients above were classified into two group: cleft lip and alveolus (CLA), and cleft lip and palate (CLP). After classification of unilateral and bilateral group, again unilateral group was subdivided into left and right side category, and its distribution was checked. The distribution according to their sexuality and cleft type is shown on Table 1.

### 2) Abnormalities in number of teeth, morphology, eruption and location

With the first visit charts and records from Orthodontic and Oral and Maxillofacial Surgery Department including radiographs (orthopantomogram, periapical radiograph and maxillary occlusal view), diagnostic models and intra/extra-oral clinical photos, the evaluation was made for impacted teeth, supernumerary teeth, missing teeth, microdontia and their location.

Additionally, among cleft patients who have

either complex syndrome or experience of tooth extraction for caries or orthodontic purpose were excluded on this research.

### 3) Statistical analysis

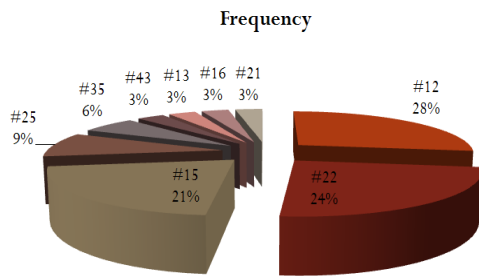
Statistical analysis was conducted with SPSS ver 13.0 to analysis if there is statistical significance between groups belong to each measurement items. statistical analysis using chi-square test was carried out on our findings. A significance level of  $p < 0.05$  was applied to all analysis

## III. RESULTS

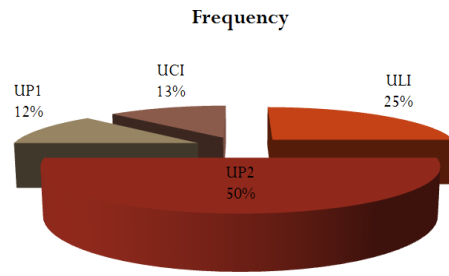
### 1. Congenital missing teeth

The congenital missing showed relatively high frequency of occurrence (53.1%); it occurred most frequently at maxillary lateral incisor (52%), and maxillary second premolar (21%) was found to be considerably high as well. (Figure 1)

The frequency according to the group was high in cleft lip and palate group (58.6%) and cleft lip and alveolus group (0%) followed after. (Table 2)



**Figure 1.** Frequency of the congenitally missing teeth in each type of tooth



**Figure 2.** Frequency of the impaction in each type of tooth (UCI : Upper Central Incisor, ULI : Upper Lateral Incisor, UP1-2 : Upper 1st-2nd Premolar)

**Table 2.** Frequency of the congenitally missing teeth in each cleft type

Cleft type	Right (n=6)	Left (n=17)	Bilateral (n=9)	Total
Cleft lip and alveolus (n=3)	0	0	0	0
Cleft lip and palate (n=29)	3	8	6	17(58.6%)
Total(n=32)	3(50%)	8(47%)	6(66.6%)	17(53.1%)

**Table 3.** Frequency of the supernumerary teeth in each cleft type

Cleft type	Right	Left	Bilateral	Total
Cleft lip and alveolus (n=3)	0	0	0	0
Cleft lip and palate (n=29)	0	1	0	1(3.4%)
Total(n=32)	0	1	0	1(3.1%)

**Table 4.** Frequency of the impacted teeth in each cleft type and side

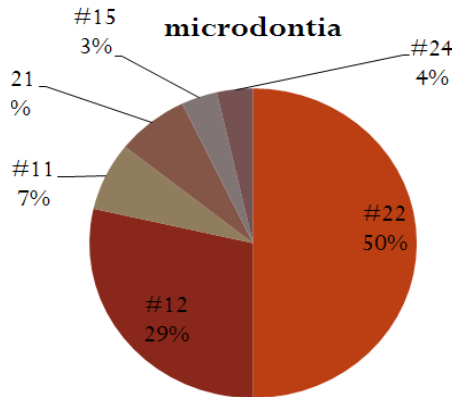
Cleft type	Right	Left	Bilateral	Total
Cleft lip and alveolus (n=3)	0	1	0	1(33.3%)
Cleft lip and palate (n=29)	0	4	3	7(24.1%)
Total(n=32)	0	5	3	8(25%)

## 2. Supernumerary teeth

The supernumerary teeth was found as 3.1% (a patient) in overall cases and it positioned between maxillary central and lateral incisor. (Table 3)

## 3. Impacted teeth

The impacted teeth were observed for 25% among the patients (Table 4), and its occurrence by teeth was in the order of maxillary second premolar (50%), maxillary



**Figure 3.** Frequency of the microdontia in each type of tooth.

**Table 5.** Frequency of the microdontia in each cleft type and side

Cleft type	Right	Left	Bilateral	Total
Cleft lip and alveolus (n=3)	0	3	0	3(100%)
Cleft lip and palate (n=29)	4	9	7	20(68.9%)
Total(n=32)	4	12	7	23(71.8%)

**Table 6.** The maxillary permanent lateral incisor anomalies

Cleft type	Right	Left	Bilateral	Total
Cleft lip and alveolus (n=3)	0	3	0	3(100%)
Cleft lip and palate (n=29)	6	12	8	26(89.6%)
Total(n=32)	6	15	8	29(90.6%)

lateral incisor (25%), maxillary central incisor (12.5%), and maxillary first premolar (12.5%). (Figure 2) In the occurrence by groups, the cleft lip and alveolus group (33%) revealed higher frequency than group of cleft lip and palate (24.1%).

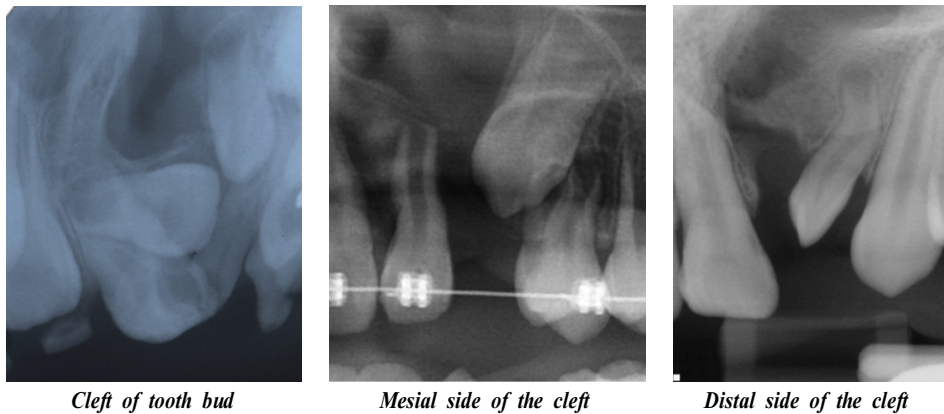
#### 4. Microdontia

Microdontia was found at 71.8% in total and by teeth the highest percentage of frequency of occurrence appeared at maxillary lateral incisor (79%); maxillary

central incisor (14%), maxillary first premolar (4%), and maxillary second premolar (3%) were followed. At the point of groups, the frequency came out 100% for cleft lip and alveolus group, and 68.9% for cleft lip and palate group. (Table 5)

#### 5. The maxillary permanent lateral incisor in the cleft area

Among overall 32 patients, abnormalities of permanent maxillary lateral incisor were seen at 29 patients (90%). The lateral incisor



**Figure 4.** The proximity of the cleft to Maxillary permanent Lateral incisors

**Table 7.** The proximity of the cleft to maxillary permanent lateral incisors (n = 40)

Cleft type	Missing	Mesial side of the cleft	Distal side of the cleft	Either side of the cleft	Total
Cleft lip and alveolus	0	0	3	0	3
Cleft lip and palate	13	1	22	1	37
Total (Frequency)	13 (32,5%)	1 (2,5%)	25 (62,5%)	1 (2,5%)	40

missing (17 lateral incisor missing) of 10 patients (34,4%), abnormal morphology (microdontia or peg-lateralis) of 17 patients (58,6%), and both missing and abnormal morphology of 2 patients (6,8%) were noticed, (Table 6)

And for the case that maxillary lateral incisor is not missing but present, it can be classified into one of three groups as below, (Figure 4)

Type 1: **Mesial side of the cleft**

Type 2: **Distal side of the cleft**

Type 3: supernumerary tooth, both mesial and distal side of cleft; **Cleft of tooth bud**

4 lateral incisors missing for non-cleft

side, and the 13 teeth missing for cleft side was found when relationship between cleft and maxillary lateral incisor considered, (Table 7) When lateral incisor presents, it mostly positioned on distal side of cleft (62,5%) and 85% of lateral incisor was microdontia.

## 6. Hypodontia outside the cleft alveolus

Among 32 patients, missing teeth was found for 8 patients and it is 12 teeth missing in total. Missing only maxillary premolar was for 6 patients. Mandibular premolar missing happened to only one patient and missing both maxillary and mandibular premolar was also found for a

**Table 9.** Missing second premolars on cleft lip and palate (n = 29)

Sex	Right	Left	Bilateral	Total
Male(n=21)	1	3	2	6(28.5%)
Female(n=8)	1	1	0	2(25%)
Total(n=29)	2	4	2	8(27.5%)

**Table 10.** Missing second premolars on cleft lip and palate

Nubmer of patients					Number of patients with missing Second premolars					Missing 2nd premolars
Sex	Rt.	Lt.	Bilateral	Total	5UR	5LL	5UR 5UL	5UR 5UL	Total	Number
Male	4	8	9	21	2	1	2	1	6	10
Female	2	6	0	8	2	0	0	0	2	2
Total	6	14	9	29	4	1	2	1	8	12

patient. Missing teeth were 9 of maxilla and 3 of mandible. (Table 8)

From 29 patients of cleft lip and palate, 8 was noticed (27.5%) for second premolar missing; among 12 premoalr missing, 10 (83.3%) was in maxilla and 2 (16.6%) was in mandible. (Table 9-10)

#### IV. DISCUSSION

To treat patients experiencing cleft alveolus, abnormalities on number and morphology of teeth has brought many clinical considerations for not only oral and maxillofacial surgeons but also general practitioners. In those patients, the needs of prosthesis and orthodontic treatment would increase, and broad approaches on research

of abnormal teeth would make preventive treatment possible.

In 1977, Thordur<sup>6)</sup> conducted a survey to figure out frequencies for permanent tooth missing and abnormalities based on 1,116 children living in Iceland. Excluded third molar missing, frequency of occurrence on permanent congenital missing was 6.7% for boys, and 8.9% for girls. Average number of missing teeth for each child was 1.9. In girls, the frequency of occurrence was in the order of mandibular second premolar (55%), maxillary second premolar (19%), and maxillary lateral incisor (18%); for boys, 51%, 18%, and 10% were found respectively.

This research based on patients with cleft alveolus, congenital missing frequency was 53.1%, higher than that of normal children, and the most frequent tooth for missing was

noticed as maxillary lateral incisor which showed different aspect from normal children.

Millhon and Stafne<sup>7)</sup> in 1941, Bohn<sup>8)</sup> in 1950, Nagai<sup>9)</sup> in 1963, Fishman<sup>10)</sup> in 1970, Zilberman<sup>11)</sup> in 1973, and Ranta et al.<sup>4)</sup> in 1986 conducted researches regarding number, shape and eruption age of teeth for patients with cleft lip and palate. According to Ranta, the tooth missing was occurred in frequency of 31.5%. And he also reported that the more extended CLP patients experience, the higher number of missing teeth they have. In 1964 as Olin<sup>12)</sup> reported, among CLP patients congenital tooth missing took a rate of 24%, and at least 15 types of tooth abnormalities happened more to the CLP patients than normal persons. Ranta<sup>4)</sup> mentioned maxillary lateral incisor as the most susceptible tooth to the cleft area among both primary and permanent dentition, and it is mostly appeared to be missing or microdontia. The frequency of tooth missing in outside of cleft area was also considerably higher than that of normal children, and it occurred by order of maxillary second premolar, maxillary lateral incisor, and mandibular second premolar; the frequency of occurrence reported by Ranta<sup>4)</sup> was 32.3%, 10.4%, and 7.6% respectively. The lateral incisor was often missing on cleft area.

This can possibly be explained by the proximity of the cleft to the lateral incisor region, which may strike and divide the primordial tissue related to the developing lateral incisor field. When the cleft divides it evenly, two teeth will develop, one on

either side of the cleft. The one on the mesial side usually resembles an central incisor, and the one on the distal side tends to resemble a canine (Figure 4).

The result from this research, 27% of patients with cleft lip and/or palate had a missing of second premolar. In statistical and clinical comparison, this value revealed higher percentage of missing than that of normal persons in range of 2.5 ~ 6.6%. A rather high prevalence of congenitally missing premolars was found by Olin<sup>12)</sup>, who reported an incidence of 24% in cleft lip and palate patients.

Studied by Baek et al.,<sup>13)</sup> missing tooth was of 56.8%, and frequency of occurrence by tooth was shown high in lateral incisor and second premolar of maxilla. In comparison of missing by cleft groups, it occurred more frequently in the groups of CLP (cleft lip and palate), and CLA (cleft lip and alveolus) than the groups of CL (cleft lip) and CP (cleft palate). And within the groups of CL, CLA and CLP, bilateral subgroup presented higher frequency of the missing than unilateral subgroup. Supernumerary teeth were found as 11.2%, and it mostly occurred between maxillary lateral incisor and canine. Impacted teeth was observed at percentage of 18.3. Microdontia of 15.8% was also noticed with the highest occurrence frequency in maxillary lateral incisor and maxillary canine.

Studied by Kang et al.,<sup>14)</sup> tooth abnormalities were found in 98% for male and 100% for female patients, and in the most of patients with cleft alveolus showed abnormalities of



their teeth.

The order of predominance in the same study was maxillary lateral incisor (66.3%), maxillary second premolar (21.5%), mandibular second premolar (4.6%)/ maxillary central incisor (4.6%), mandibular incisor (3%), and maxillary canine. The most vulnerable tooth during tooth formation was permanent maxillary lateral incisor, and result from the damage came out to be either congenital missing or abnormal shape.

## V. CONCLUSION

1. The congenital missing showed relatively high frequency of occurrence (53.1%) among patients, and the frequency by teeth revealed in the order of maxillary lateral incisor (for the highest), maxillary second premolar and mandibular second premolar. The cleft lip and palate group presented higher frequency than the group of cleft lip and alveolus. And within the cleft lip and palate group, the missing occurred more in bilateral subgroup than unilateral.
2. Microdontia was shown in 71.6% of CLP patients. It occurred most frequently in the maxillary lateral incisor. Frequency of microdontia in cleft lip and alveolus group was higher than that of cleft lip and palate group.
3. According to the result from chi-square test analysis on the congenital missing

of maxillary incisor and second premolar, no statistical significances were found between groups of male/female and unilateral/bilateral cleft. However, among patients with cleft alveolus, comparison regarding frequency of second premolar missing between cleft area and outside of cleft area showed statistical significance ( $p=0.10$ ).

4. This research again confirmed the fact that CLP can affect adjacent immature tissue of maxillary lateral incisor in development, and it can make also certain influences on maxillary second premolar in the distance.

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