

## Odontogenic Cysts: Analysis of 2.944 cases in Chile

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### ABSTRACT

**Introduction:** Odontogenic cysts constitute a group of frequent intraosseous lesions characteristic in the maxillary bones and one of the main causes of the destruction of these bones. In Chile there are no retrospective studies of these lesions as a whole.

**Objective:** The purpose of this study is to determine the frequency of these lesions in so far as they were diagnosed and registered in the Referral Institute for Oral Pathology (IREPO) of the University of Chile in two age groups as well as to analyze and to compare the data obtained with the data published in previous studies.

**Material and Method:** We studied the records from IREPO of the University of Chile for the period between 1976 and September, 2004; and we determined the frequency according to age, gender and site of each of these lesions. We compare two age groups: younger than or equal to 15 years old and older than 15 years old. Those cases in which the information did not suffice for the purposes of analysis were not considered. All the histological slides were reclassified according to the diagnostic criteria included in the Histological Typification of the World Health Organization.

**Results:** We found 2.944 odontogenic cysts (OC), of which 1.935 (65.7%) were inflammatory cysts and 1.009 were developmental cysts. Out of this total, there were 1.554 cysts (52.8%) in men and 1.390 (47.2%) in women. The most frequent cysts were 1.494 radicular cysts (50.7%), 546 dentigerous cysts (18.5%), 421 keratocysts (14.3%) and 328 residual cysts (11.1%).

These four varieties represent 94.7% of the OC, that is, 2789 cases. In the population younger than or equal to 15 years of age the developmental cysts (354 cases) are more frequent than the inflammatory cysts (155 cases), the most frequent being dentigerous cysts (240 cases).

**Key words:** Cysts, odontogenic cysts, keratocyst, radicular cyst, dentigerous cyst.

### RESUMEN

**Introducción.** Los quistes odontogénicos constituyen un grupo de frecuentes lesiones intraóseas propias de los maxilares y una de las principales causas de destrucción de estos huesos. En Chile no existen estudios retrospectivos del conjunto de estas lesiones.

**Objetivos.** El propósito de este trabajo es determinar la frecuencia de estas lesiones diagnosticadas y registradas en el Instituto de Referencia de Patología Oral (IREPO) de la Universidad de Chile en dos grupos etáreos, así como analizar y comparar los datos obtenidos con aquellos publicados en otros estudios previos.

**Material y Método.** Se revisaron los archivos del IREPO de la Facultad de Odontología de la Universidad de Chile correspondientes al período transcurrido entre 1976 y septiembre de 2004 y se determinó la frecuencia según edad, género y localización de cada una de estas entidades. Se hizo la comparación entre dos grupos etáreos (menor o igual a 15 años

y mayores a 15 años). Los casos en que la información era insuficiente para ser analizada no fueron considerados. Todas las placas histológicas fueron reevaluadas de acuerdo a los criterios diagnósticos incluidos en la Tipificación Histológica de Tumores Odontogénicos de la OMS.

**Resultados.** Se encontraron 2.944 quistes odontogénicos (QO), de los cuales 1.935 (65,7%) fueron quistes inflamatorios y 1.009 (34,3%) quistes del desarrollo. Con respecto al total de los quistes, hubieron 1.554 (52,8%) en hombres y 1.390 (47,2%) en mujeres. De las variedades reconocidas por la OMS, se encontraron la totalidad de ellas. Los quistes más frecuentes fueron: quistes radiculares 1.494 (50,7%); quistes dentígeros 546 (18,5%); queratocistes 421 (14,3%) y quistes residuales 328 (11,1%). Estas cuatro variedades representan el 94,7% del total de los QO, con 2.789 casos. En población menor o igual a 15 años predominan los quistes del desarrollo (354) por sobre los quistes Inflamatorios (155), siendo los más frecuentes los quistes dentígeros con 240 casos.

**Palabras clave:** *Quistes, quistes odontogénicos, queratociste, quiste radicular, quiste dentígero.*

## INTRODUCTION

Odontogenic cysts originate in the epithelial components of the odontogenic apparatus or from its remnants, which are entrapped within the bone or the peripheral gingival tissues. With respect to their pathogenesis, some of them are considered as “developmental” and others as “inflammatory”.

Although series about these lesions have been published in foreign literature,

there are no Chilean studies involving a quantitative analysis of all these varieties, as well as of an important number of cases.

Developmental odontogenic cysts and inflammatory odontogenic cysts are epithelial lesions, characterized by a slow growth and an expansive tendency and in spite of being entities which present a benign biological behavior, they can reach considerable size if they are not diagnosed in time and treated appropriately.

They constitute one of the main causes of the destruction of the maxillary bones.

These lesions represent a numerically important set of the total of biopsies in hospitals and specialized university centers. In studies carried out in the United States(1,2) before the current Histological Typifying of Odontogenic Tumors(3), odontogenic cysts represented 19.4% and 16.6% respectively of the total biopsies studied in Washington and in the Biopsy Service of the Dental School of the University of Oregon. Studies carried out in Canada (4) after the current classification became effective, found that these lesions represented 17.2% of the total biopsies. Tay (5) recorded a 14.9% in Singapore, while Mosqueda et al. (6) found a figure of 11.5%.

The purpose of this work is to determine the relative frequencies of these cysts, to analyze variables such as age, gender and site in two age groups and to compare our findings with other publications from different geographical areas.

## MATERIAL AND METHOD

The histopathological slides of oral biopsies with diagnoses of odontogenic cysts of the Referral Institute for Oral Pathology (IREPO) from June, 1976 to September, 2004, a period of 28 years, were re-examined. Repeated biopsies were not considered, even those performed for recurrences

after treatment. The other criterion for exclusion were the absence of information concerning the site or the patient's age.

All histological slides were re-evaluated according to current concepts, as outlined in the Histological Typification of Odontogenic Tumors of the World Health Organization (3); and from the clinical record of each case, we obtained the following information: age, gender and site.

In order to determine the site of the lesions, we considered the existence of three areas: A. anterior, B. premolar and C. molar. In the case of the jawbone, this last area includes the ramus.

## RESULTS

Out of the total of 29.364 biopsies in the IREPO, there are 12.156 males (41.4%), 17.208 females (58.6%), and 55 biopsies whose sex is undetermined.

The total of developmental and inflammatory odontogenic cysts, represent 10% of all the biopsies carried out and recorded in this Institute from 1976 until September, 2004, that is, 2.944 cases. In the maxillary bone we found 1.753 cysts (855 in women and 898 in men) and in the mandible we found 1.191 (535 in women and 656 in men).

The relative frequencies of the different lesions can be observed in Table 1.

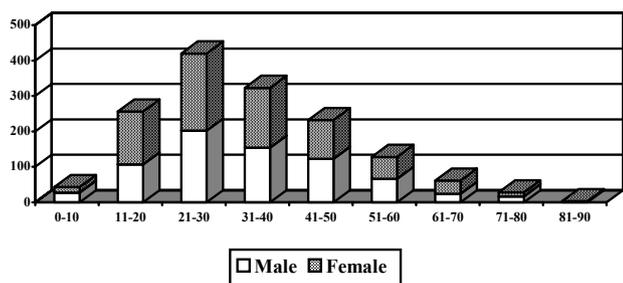
Table 2 shows the distribution according to the site, while the distribution by age and by gender of the main types of cysts can be seen in graphs 1-4. In addition, Table 3 compares the frequency of all cysts according to the age groups included in this series.

Of a total of 421 keratocysts, only 65 cases (15.4%) were associated with the syndrome of Gorlin and Goltz; and these correspond to 33 patients. Recurrences were not considered in any of the cases.

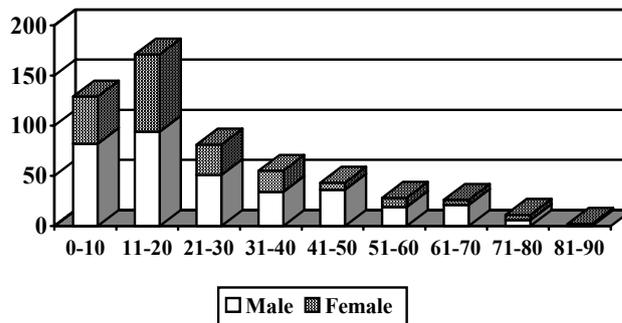
Regarding gender distribution, in the case of the dentigerous cyst we found 202 cases in women and 344 cases in men. Graphs 1 to 4 show the different age curves of the four most frequent odontogenic cysts. The dentigerous cyst presents its peak in the second decade, while keratocysts have a first peak in the second decade and a second frequency peak in the sixth decade. The residual cysts present their greatest frequency in the fifth and sixth decade, while radicular cysts reach their greatest frequency in the third decade of life.

**Table 1.** Relative frequencies of odontogenic cysts and their distribution according to gender.

|                               | MALE |      | FEMALE |      | TOTAL |      |
|-------------------------------|------|------|--------|------|-------|------|
|                               | No   | (%)  | No     | (%)  | No    | (%)  |
| Radicular Cyst                | 720  | 48,2 | 774    | 51,8 | 1494  | 50,7 |
| Dentigerous Cyst              | 344  | 63,0 | 202    | 37,0 | 546   | 18,5 |
| Keratocyst                    | 231  | 54,9 | 190    | 45,1 | 421   | 14,3 |
| Residual Cyst                 | 175  | 53,4 | 153    | 46,6 | 328   | 11,2 |
| Paradental Cyst               | 67   | 59,3 | 46     | 40,7 | 113   | 3,8  |
| Lateral Periodontal Cyst      | 10   | 58,8 | 7      | 41,2 | 17    | 0,6  |
| Eruption Cyst                 | 4    | 36,4 | 7      | 63,6 | 11    | 0,4  |
| Gingival Cyst of Adult        | 3    | 30   | 7      | 70   | 10    | 0,3  |
| Gingival Cyst of the new born |      |      | 3      | 100  | 3     | 0,1  |
| Sialo-odontogenic Cyt         |      |      | 1      | 100  | 1     | 0,03 |
| Total                         | 1554 | 52,8 | 1390   | 47,2 | 2944  | 100  |



**Fig. 1.** Distribution of 1494 Radicular Cysts according to gender and age in decades.



**Fig. 2.** Distribution of 546 Dentigerous Cysts according to gender and age in decades.

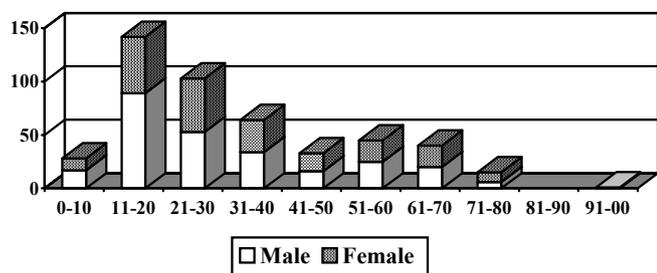


Fig. 3. Distribution of 421 Keratocysts according to gender and age in decades.

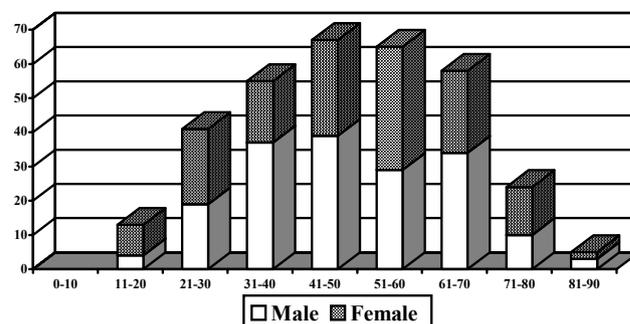


Fig. 4. Distribution of 328 Residual cysts according to gender and age in decades

Table 2. Distribution of odontogenic cysts according to localization

|             | MAXILLAR       |              |              |              |              |                | MANDIBLE     |              |               |              |             |                | T    |
|-------------|----------------|--------------|--------------|--------------|--------------|----------------|--------------|--------------|---------------|--------------|-------------|----------------|------|
|             | A              | B            | C            | >            | W            |                | A            | B            | C             | >            | W           |                |      |
| Rad.<br>%   | 757<br>(50,7)  | 102<br>(6,8) | 86<br>(5,8)  | 93<br>(6,2)  | 90<br>(6,0)  | 1128<br>(75,5) | 114<br>(7,6) | 60<br>(4,0)  | 136<br>(9,1)  | 38<br>(2,5)  | 18<br>(1,2) | 366<br>(24,5)  | 1494 |
| Dent.<br>%  | 154<br>(28,2)  | 24<br>(4,4)  | 14<br>(2,6)  | 35<br>(6,4)  | 19<br>(3,5)  | 246<br>(45,1)  | 30<br>(5,5)  | 65<br>(11,9) | 167<br>(30,6) | 26<br>(4,8)  | 12<br>(2,2) | 300<br>(54,9)  | 546  |
| Kc.<br>%    | 48<br>(11,4)   | 8<br>(1,9)   | 35<br>(8,3)  | 37<br>(8,8)  | 9<br>(2,1)   | 137<br>(32,5)  | 26<br>(6,2)  | 11<br>(2,6)  | 159<br>(37,8) | 70<br>(16,6) | 18<br>(4,3) | 284<br>(67,5)  | 421  |
| Res.<br>%   | 113<br>(34,5)  | 14<br>(4,3)  | 18<br>(5,5)  | 51<br>(15,5) | 24<br>(7,3)  | 220<br>(67,1)  | 24<br>(7,3)  | 18<br>(5,5)  | 31<br>(9,5)   | 29<br>(8,8)  | 6<br>(1,8)  | 108<br>(32,9)  | 328  |
| Para.<br>%  |                |              | 4<br>(3,5)   |              | 2<br>(1,8)   | 6<br>(5,3)     |              |              | 105<br>(92,9) |              | 2<br>(1,8)  | 107<br>(94,7)  | 113  |
| L.P.C.<br>% | 1<br>(5,9)     | 1<br>(5,9)   | 1<br>(5,9)   |              |              | 3<br>(17,6)    | 2<br>(11,8)  | 8<br>(47,1)  | 2<br>(11,8)   |              | 2<br>(11,8) | 14<br>(82,4)   | 17   |
| Erup.<br>%  | 5<br>(45,5)    |              |              |              | 1<br>(9,1)   | 6<br>(54,5)    | 1<br>(9,1)   | 1<br>(9,1)   | 3<br>(27,3)   |              |             | 5<br>(45,5)    | 11   |
| G.C.A<br>%  | 1<br>(10,0)    | 2<br>(20,0)  | 1<br>(10,0)  |              | 1<br>(10,0)  | 5<br>(50,0)    | 2<br>(20,0)  | 1<br>(10,0)  | 1<br>(10,0)   |              | 1<br>(10,0) | 5<br>(50,0)    | 10   |
| G.C.I.<br>% |                | 1<br>(33,3)  |              |              | 1<br>(33,3)  | 2<br>(66,6)    |              | 1<br>(33,3)  |               |              |             | 1<br>(33,3)    | 3    |
| Sialo.<br>% |                |              |              |              |              |                |              |              |               | 1<br>(100)   |             | 1<br>(100)     | 1    |
| Total       | 1079<br>(36,7) | 152<br>(5,2) | 159<br>(5,4) | 216<br>(7,3) | 147<br>(5,0) | 1753<br>(59,5) | 199<br>(6,8) | 165<br>(5,6) | 604<br>(20,5) | 164<br>(5,6) | 59<br>(2,0) | 1191<br>(40,5) | 2944 |

Rad.: Radicular Cyst; Res.:Residual Cyst; Dent.:Dentigerous Cyst; Kc.: Keratocyst; Para.: Paradental Cyst; L.P.C.: Lateral Periodontal Cyst; Erup.: Eruption Cyst; G.C.A.:Gingival Cyst of Adults; G.C.I.: Gingival Cyst of Infants; Sialo.: Sialo-odontogenic Cyst; A Anterior zone; B premolar zone; C Molar zone; > Two or more contiguous zones; W Without exact localization and T Total.

**Table 3.** Relative frequencies of odontogenic cysts in two age groups and distribution according to gender.

|          | 0-15 years |     |     |         | ≥15 years |      |      |         | TOTAL |
|----------|------------|-----|-----|---------|-----------|------|------|---------|-------|
|          | M          | F   | n   | %       | M         | F    | n    | %       |       |
| Rad.     | 74         | 73  | 147 | (9,8)   | 646       | 701  | 1347 | (90,2)  | 1494  |
| Dent.    | 139        | 101 | 240 | (44,0)  | 205       | 101  | 306  | (56,0)  | 546   |
| Kc.      | 55         | 43  | 98  | (23,3)  | 176       | 147  | 323  | (76,7)  | 421   |
| Res.     | 0          | 2   | 2   | (0,6)   | 175       | 151  | 326  | (99,4)  | 328   |
| Para.    | 5          | 1   | 6   | (5,3)   | 62        | 45   | 107  | (94,7)  | 113   |
| L.P.C.   | 1          | 0   | 1   | (5,9)   | 9         | 7    | 16   | (94,1)  | 17    |
| Erup.    | 4          | 6   | 10  | (90,9)  | 0         | 1    | 1    | (9,1)   | 11    |
| G. C.A.  | 1          | 1   | 2   | (20,0)  | 2         | 6    | 8    | (80,0)  | 10    |
| G. C. I. | 0          | 3   | 3   | (100,0) | 0         | 0    | 0    | (0,0)   | 3     |
| Sialo.   | 0          | 0   | 0   | (0,0)   | 0         | 1    | 1    | (100,0) | 1     |
| TOTAL    | 279        | 230 | 509 | (17,3)  | 1275      | 1160 | 2435 | (82,7)  | 2944  |

Rad.: Radicular Cyst; Dent.:Dentigerous Cyst; Kc.: Keratocyst; Res.:Residual Cyst Para.: Paradental Cyst; L.P.C.: Lateral Periodontal Cyst; Erup.: Eruption Cyst; G.C.A.:Gingival Cyst of Adults; G.C.I: Gingival Cyst of Infants; Sialo.: Sialo-odontogenic Cyst;

Although dentigerous cysts may involve any unerupted tooth, mandibular third molars were involved most often, in 28.9% of the cases. The second most frequent occurrence was in maxillary canines, in 20.1% of the cases. In third place regarding frequency we find the second inferior bicuspids, in 12.1% of the cases, followed by the mandibular canines, in 10.5% of the cases; then upper central incisors 6.2%; and finally supernumary mesiodens in 5.5% of the cases.

With regard to the site, in this study residual cysts followed the site of the radicular cysts, but there were significant differences with respect to their size, where the residual cysts more often reached more than one area of localization.

In general, the molar region presents a higher percentage of developmental cysts, such as keratocysts and dentigerous cysts, while the upper anterior zone presents a higher percentage of inflammatory cysts.

The paradental in general are localized in the molar mandibular region.

## DISCUSSION

Odontogenic cysts constitute frequent benign lesions of the maxillary bones.

In general, their differential diagnosis requires radiographic clinical data, since many of them possess similar histological characteristics. The most trustworthy sources for obtaining information relative to the frequency, clinical-radiographical and histological characteristics of these lesions are the services of oral pathology, where these biopsies are processed. The biopsies which are registered in the IREPO generally

come from the surgical departments of our (state-owned) university or from hospitals and public clinics which attend a middle and low-income public.

In this study, odontogenic cysts make up 10% of the 29,364 biopsies. These results are similar to those obtained by Mosqueda et al.(6) 11.5% and different than those of Daley et al (4), who found 17.2% and Tay (5), who found 14.9% in Singapore.

Radicular cysts are lesions which are produced as a consequence of pulpar necrosis and therefore, are considered to be of an inflammatory nature. In this study we found that the radicular cysts represent 50.7% of all odontogenic cysts, being the most frequent of all these lesions in relative terms; this finding is similar to that of Tay (5), who also found 50.7% and is close to that of Mosqueda et al. (6), with cases coming from university services (52%) and to that of Shear (7), who reported 52.3% frequency for radicular cysts. Thompson (2) in his report covering a six year period in the Biopsy Service of the University of Oregon found that radicular cysts constituted 47.5% of the 581 cases, while Bhaskar (1) found a greater frequency, 57.8%. However, this lesion in the age group younger than or equal to 15 years of age represents only 28.9% of the total, occupying the third place in frequency.

In Canada Daley et al. (4) found that these lesions represented 65.2%. Nevertheless, in this percentage, residual cysts were included. In our study, the sum of radicular and residual cysts was 61.9%.

With respect to the site, it is interesting that 50.7% of the radicular cysts were situated in the upper anterior zone.

This may be due to the fact that esthetic factors lead people to conserve these dental pieces, and therefore, they are more likely to be subject to long-term chronic inflammatory processes, without the adequate resolutive endodontic treatment.

Residual cysts are those which remain in the maxillary bones after the causal tooth has been extracted. One of the most interesting aspects of this study is the elevated number of cases of residual cysts; they represent 11.2% of all odontogenic cysts, the highest figure in all the studies which we have previously mentioned. Only in the study of Ahlfors et al.(8) in Sweden was the frequency of residual cysts higher than in ours, with 12.5% of all the odontogenic cysts. In Tay's series (5) the relative frequency of this lesion accounted for 8.8% of the cases, which can also be considered a relatively high frequency. The other studies present lower frequencies: Bhaskar (1) found 5.1%; Thompson (2) 4.2%; and Mosqueda et al. (6) 2.2%. In the Bhaskar study the author recommended caution to the dental community regarding surgical procedures, specially in cases in which apical inflammatory lesions are observed.

In the Mexican (6) studies as in ours radicular cysts were found in a greater number in females, while the residual cysts were more frequent in males.

When we examined the relative frequency of residual cysts during this period of 28 years, we found that this figure did not show significant annual variations: it ranged between 9.3% and 12% of the total of odontogenic cysts. In the population younger than 15 years old are almost nonexistent (0.6%).

With respect to dentigerous cysts, in our study they occupied the second place in relative frequency, the figure being 18.5%, just as in the studies of Shear (7) 16.6%, Ahlfors et al.(8) 19.4%, Daley et al. (4) 24.1%, Mosqueda et al. (6) 33.0% and Bashkar(1) 33.7%. The exception was Tay's series (5) in which they occupied the third place with a frequency of 15.2%. A greater frequency of dentigerous cysts is found in the male gender than in the female gender. Although this difference appears in the childhood population, it is not as great as in the case of the total population and of the adult population.

Regarding the site of dentigerous cysts, our results differ from the Waldron's findings (9), since the upper third molars are the third most frequent site in his study.

Within the group of dentigerous cysts, we included 37 cases of inflammatory follicular cysts (10) (IFC), an entity which is not considered in the Histological Typification of Odontogenic Tumors (3). There are various reports published in the literature (11-14) which refer to cystic lesions arising in association with a primary predecessor tooth which has been infected by the cystic degeneration of the reduced epithelium of the enamel organ of the permanent successor tooth. Main (15) proposed the names of IFC for these lesions. In our records, 21 of these 37 cases were patients who were being treated in our Faculty, and in the previous radiographs we only observed the successor tooth with its pericoronarious sack. After the pulpar necrosis of the tem-

porary tooth and an inflammatory periapical condition, we observed the appearance of a cystic lesion associated with the permanent successor tooth. These cases were diagnosed as inflammatory follicular cysts. The 16 remaining cases came from different origins and the diagnosis was based on histological observation and on previous clinical data.

With respect to keratocysts, these correspond to the third place within our study (14.3%). So too, this lesion also was the third most frequent in the studies of Mosqueda et al. (21.5%) and Daley et al. (4.8%), taking into consideration that the figure from the study of Mosqueda et al. is the highest of the works that we compared.

In relation to gender, we observed a moderate predominance of males, which other authors have also referred to (6). Regarding the age distribution, we observed two peaks in both genders, the highest one in the second and third decade with a lower peak in the sixth decade: these findings coincide with those of Ahlfors et al.(8) There was a 3:1 ratio between the adult population and the childhood population examined. However in the cases associated with the Gorlin-Goltz syndrome, the ratio between the two populations was almost equitable, with 34 and 31 cases in the respective populations.

With respect to paradental cysts, the majority were located in relation to the third lower molars and only 6 cases corresponded to the third upper molars. Although we found that male cases predominated, with 59.3% of the total, this difference is much less than the referred to by Mosqueda et al.(6), with 83.3% for the male gender.

Although the classification of the World Health Organization (3) describes an infected mandibular buccal cyst as a variety of paradental cysts, we did not find a single one diagnosed as such in our study. Neither were they mentioned in the studies of Mosqueda et al. (6) in Mexico nor those of Tay in Singapore (5), which implies that their prevalence may be very low or that they are diagnosed only on the basis of clinical radiology and are not sent for histopathological examination.

It is interesting to point out that in the childhood population, unlike the adult population, developmental cysts are the most frequent and that dentigerous cysts are the most frequent in relative terms in the population with an age younger than or equal to 15 years old. So too, in the adult population radicular cysts were the most frequent, the figure being 55.3%.

The relative frequencies of the majority of odontogenic cysts studied by biopsy and treated in the Dental Faculty of the University of Chile are comparable with similar studies in the literature. The relative frequency of some cysts is higher than that found in other studies, specially residual cysts. Our results emphasize the necessity of radiographs before exodontics and of a careful and complete curettage in the cases in which an apical lesion appears.

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