Frequency and distribution of teeth requiring endodontic therapy in an Argentine population attending a specialty clinic in endodontics

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Objectives: To determine the frequency and distribution of 975 teeth in need of endodontic treatment in an Argentine patient pool and to compare the results with previously published surveys. **Methods:** Of the 975 teeth from 860 individuals (age range 7–86 years) were endodontically treated during 2007 by postgraduate students enrolled in a specialisation programme in Endodontics. All patients were examined clinically and radiographically. For each case, information was collected in a questionnaire including location of the affected tooth, age and gender and reasons for endodontic treatment. Data were analysed by the Student *t*-test, the Fisher exact test, and the chi-square test with a significance of *P* < 0.05. **Results:** Of the 975 treated teeth, 543 (55.69%) were maxillary and 432 (44.30%) mandibular teeth. 635 (65.13%) were from females and 340 (34.87%) from males. Significant differences were found between the maxillary and mandibular arch (*P* = 0.01). Molars and premolars required significantly more frequent endodontic treatment than canines and incisors (*P* < 0.001). The most frequently treated tooth was the mandibular right first molar (9.12%) followed by the mandibular left first molar (7.07%). The most frequently diagnosed pathosis was irreversible pulpitis (36.00%), pulp necrosis (30.80%), apical periodontitis or the presence of easily discernible periapical radiolucent areas (27.20%). Caries (59.18%) and failure of previous endodontic treatment (26.97%) were responsible for most of the affected teeth. **Conclusions:** Comparison with previous surveys revealed that more females than males received endodontic treatment and that mostly molars and premolars were in need of endodontic treatment. The high number of root filled teeth requiring retreatment is in agreement with a pattern similar to that observed in other countries and supports the need for more specialists in endodontics in the Republic of Argentina.

Key words: Dental survey, endodontics, epidemiology, root canal treatment

Pulp infection constitutes one of the most important sequels of amongst others, dental caries, periodontal disease, trauma and inadequate restorative procedures. Pulp infection generally proceeds to pulp necrosis and apical periodontitis, frequently combined with apical bone or root resorption. Therefore, endodontic therapy must be planned according to the diagnosis of the disease that is present. Epidemiological studies that offer detailed documentation of dental health records have been of great value to assess and improve the knowledge of the incidence and distribution of patients needing endodontic treatment in a predetermined population. According to Eriksen[1] epidemiology is related with the study of disease, which affects a community of people rather than a single individual. In this respect, numerous studies have historically been performed in different countries[1–8]. In spite of the fact that an increase in demand for restorative dentistry has been responsible for a growing need of endodontic therapy and the recognition of endodontics as a specialty in numerous dental schools in the Republic of Argentina, there is scarce epidemiological information on the prevalence and distribution of root canal treatments of the Argentine population[9]. Due to this lack of data, the aim of the current study was to present the incidence and distribution of endodontically treated teeth in a general adult Argentine population treated in 2007 in a specialty clinic in endodontics.

MATERIALS AND METHODS

This survey involved 860 patients who had 975 teeth treated endodontically during 2007 at the Specialty Clinic in Endodontics at the University of El Salvador/

Argentine Dental Association (USAL/AOA School of Dentistry) Buenos Aires, Republic of Argentina. Of these patients, 13.84% needed root canal therapy on more than one tooth at the time of enrollment. Treatment was performed by 13 postgraduate students who were supervised by qualified endodontists. Exclusion criteria were requirements for surgical intervention, HIV infection or presence of other multiple systemic diseases. Patients with diabetes were, however, included in the study. An informed consent form approved by the Ethics Committee of the institution was presented and explained to potential participants. After written approval the patients underwent a thorough clinical examination and a complete series of periapical radiographs were made using Kodak 32 ×43 mm ultraspeed films (Eastman Kodak Company, Rochester, NY, USA) and a DSJ X-ray unit (Dental San Justo, Buenos Aires, Argentina) set at 70 kV and 10 mA. A long cone paralleling technique with a film-focus distance of 27 cm was used. After a diagnosis was finalised the teeth were treated endodontically. Most were treated in one-visit (including retreatments), which included preparation and obturation of the root canals using a standardised technique. The cervical portion of the root canals were enlarged with Gates Glidden burs (Maillefer, Ballaigues, Switzerland). This was followed by a step-back preparation technique using manual K-type files (Maillefer). Irrigation of the canals was performed with 2.5% NaOCl followed by 17% EDTA. Gutta-percha and AH26 (Maillefer/Dentsply, Ballaigues, Switzerland) or Grossman's cement (Farmadental, Buenos Aires, Argentina) were used for root canal obturation. For each case, information was collected by means of a questionnaire addressing location of the affected tooth, age and gender, and reasons for endodontic treatment. Records from the clinical and radiographic examination were obtained by two trained and previously calibrated endodontists. The calibration exercise consisted of the evaluation of 100 radiographs of completed endodontic cases. In case there was a disagreement between the evaluators a mutual consensus was reached after a joint review.

Statistical analysis

Data were statistically analysed with GraphPad InStat version 3.05 for Windows 95 (GraphPad Software, San Diego CA, USA). The Student *t*-test was used to determine if a difference existed between the age of male and female patients. The Fisher exact test was used to determine variables between the maxilla and mandible, variables between gender and the prevalence of different pathologies. The results of the pulp and periapical status were analysed with the chi-square test. The level of significance was set at $P < 0.05$.

RESULTS

The calibration exercise revealed that the inter-examiner agreement ratio was 94%, which represents a strong inter-observer agreement. Of the 975 teeth that were endodontically treated, 543 (55.69%) were maxillary and 432 (44.30%) mandibular teeth. Of these, 635 (65.13%) were in females and 340 (34.87%) in male patients with a mean age of 41.2 years, range of 7–86 years. The age range for males was 7–86 years and for females 9–83 years. No statistically significant difference ($P > 0.05$) was established with respect to ages between male and female patients. *Table 1* shows the number and frequency of teeth requiring endodontic treatment according to their location and gender. Statistically significant differences were found between

Table 1 Number and frequency of 975 teeth requiring endodontic treatment according to location and gender

Tooth	Location Right, *n* (%)	Location Left, *n* (%)	Female Right, *n* (%)	Female Left, *n* (%)	Male Right, *n* (%)	Male Left, *n* (%)
Maxilla						
Central incisor	34 (3.48)	42 (4.30)	23 (2.35)	28 (2.87)	11 (1.12)	14 (1.43)
Lateral incisor	37 (3.80)	36 (3.70)	20 (2.05)	24 (2.46)	17 (1.74)	12 (1.23)
Canine	20 (2.05)	21 (2.15)	10 (1.02)	14 (1.43)	10 (1.02)	7 (0.71)
First premolar	36 (3.70)	37 (3.80)	20 (2.05)	22 (2.25)	16 (1.64)	15 (1.53)
Second premolar	36 (3.70)	38 (3.90)	22 (2.25)	31 (3.17)	14 (1.43)	7 (0.71)
First molar	62 (6.35)	60 (6.15)	37 (3.79)	37 (3.79)	25 (2.56)	23 (2.35)
Second molar	37 (3.80)	42 (4.30)	30 (3.07)	30 (3.07)	7 (0.71)	12 (1.23)
Third molar	1 (0.10)	4 (0.41)	1 (0.10)	3 (0.30)	0 (0.00)	1 (0.10)
Mandible						
Central incisor	6 (0.61)	10 (1.02)	2 (0.20)	5 (0.51)	4 (0.41)	5 (0.51)
Lateral incisor	10 (1.02)	10 (1.02)	5 (0.51)	7 (0.71)	5 (0.51)	3 (0.30)
Canine	8 (0.82)	6 (0.61)	7 (0.71)	4 (0.41)	1 (0.10)	2 (0.20)
First premolar	17 (1.74)	24 (2.46)	13 (1.33)	20 (2.05)	4 (0.41)	4 (0.41)
Second premolar	16 (1.64)	27 (2.76)	11 (1.12)	23 (2.35)	5 (0.51)	4 (0.41)
First molar	89 (9.12)	69 (7.07)	57 (5.84)	39 (4.00)	32 (3.28)	30 (3.07)
Second molar	57 (5.84)	65 (6.66)	37 (3.79)	40 (4.10)	20 (2.05)	25 (2.56)
Third molar	4 (0.41)	14 (1.43)	4 (0.41)	9 (0.92)	0 (0.00)	5 (0.51)

Table 2 Reasons for endodontic treatment according to gender

	Total, n (%)	Female, n (%)	Male, n (%)
Caries	577 (59.18)	363 (57.10)	214 (63.10)
Retreatment	263 (26.97)	191 (30.00)	72 (21.20)
Trauma	17 (1.74)	12 (1.90)	5 (1.50)
Root resorption	2 (0.21)	0 (0.00)	2 (0.60)
Periodontal disease	47 (4.82)	24 (3.80)	23 (6.80)
Others	69 (7.07)	46 (4.71)	23 (2.35)

the maxilla and the mandible ($P = 0.01$). In both maxillary and mandibular arch, molars and premolars were significantly more affected by pathologies that required endodontic treatment than canines and incisors ($P < 0.001$). The number of teeth in females requiring endodontic treatment differed significantly from males ($P < 0.05$). The most frequently treated tooth was the mandibular right first molar (9.12%) the mandibular left first molar (7.07%), the mandibular left second molar (6.66%), the maxillary right first molar (6.35%) and the maxillary left first molar (6.15%). The lowest frequency of treatment was for mandibular and maxillary third molars followed by mandibular and maxillary canines and incisors. The reasons for endodontic treatment according to gender are shown in *Table 2*. The highest percentage of teeth that needed treatment occurred in females. Caries and its sequelae as well as failure of previous endodontic treatment were the main reason and accounted for 59.18% and 26.97% respectively. The most frequent pathologies found were irreversible pulpitis (36.0%), followed by pulp necrosis (30.80%), apical periodontitis or the presence of easily discernible periapical radiolucent areas (27.20%). Fifty-nine teeth (6.05%) did not show detectable pulp or periapical pathologies. Most of these had considerable loss of coronal structure and were subsequently treated for further prosthetic restoration. According to the results shown in *Table 2*, differences between females and males were significant ($P = 0.0024$) only for the presence of a previous endodontic failure. Only 14 (1.62%) individuals presented with diabetes [6 (0.69%) females and 8 (0.93%) males]. The remaining 846 patients presented with a non-contributory medical history.

DISCUSSION

Preservation of teeth affected by different pathologies constitutes the most important objective of modern endodontics. In this study the frequency and distribution of 975 teeth requiring endodontic treatment was evaluated in a specialty clinic in endodontics and the results were compared with previously published surveys. It must be emphasised that interpretation of information from clinical and radiographic examina-

tion can sometimes be misleading, especially because inter-observed differences may exist. To minimise this, strict criteria for interpretation of the findings was obtained by prior calibration of the examiners leading to reliable data collection. Our findings showed that more teeth in the maxilla than in the mandible required endodontic treatment. These results are in agreement with others[2,7,10,11] but contradict Wayman et al.[3] and Gulsahi et al.[12] Wayman et al.[3] reported no difference between maxilla and mandible. More recently, Gulsahi et al.[12] reported that the percentage of teeth with apical periodontitis, that required endodontic treatment was similar for maxillary and mandibular teeth. In this study, female patients required endodontic treatment more often than males. These results support early observations by Molven[13] but contradict others[3,10,12,14], who reported that male patients more often required endodontic treatment. Hull et al.[15] also found that males more often required endodontic treatment, but not for retreatment cases.

The frequency of affected maxillary and mandibular incisors tends to support previous findings by Al-Negrish[7]. The results of this study also revealed that the predominant reason for endodontic treatment of upper anterior teeth was because of trauma or caries with pulp involvement. Periapical radiolucencies were found mostly as a result of previous endodontic treatment. These findings are supported by previous reports[11,16,17] and suggest that root canal therapy does not necessarily prevent this type of pathology. It was not possible, however, to determine if these periapical pathologies were undergoing further healing, but since the patients were uncomfortable and/or the teeth showed a lack of definitive restorations with considerable coronal damage and the root canal system was exposed to oral saliva and bacterial recontamination[18] there was every indication for the need of endodontic retreatment[19]. Although in other studies panoramic radiographs were used[20–22], in this study a complete series of periapical radiographs was made since they provide better detailed images of the periapical periodontium[6,11,23,24].

Amongst other causes for endodontic treatment, teeth that did not show detectable pulp or periapical disease but presented with considerable loss of coronal structure were endodontically treated in preparation of definitive prosthetic restoration. This study had 14 patients with diabetes. This figure was less than 5% of the total population and correlates well with those of Fouad and Burleson[25] and Mindiola et al.[26] Most of these patients presented with gross decay and/or apical periodontitis frequently combined with advanced periodontal disease and high rate of tooth loss.

Although this survey was based on a relative low number of teeth, the results nevertheless suggest that there is a need for endodontic treatment in the general

Scavo *et al.*

Argentine population. According to the questionnaire, most of the failed endodontic treatments were cases treated by general practitioners. The need for the high rate of retreatments performed in this study indicates that the quality of root fillings was poor, which contributed to the high number of endodontic failures. In this respect, the number of failed endodontic treatments that were in this survey maintained a pattern of prevalence similar to that observed in other countries[4,11,12,26]. As a result of these findings, the implementation of more simplified and standardised endodontic procedures as well as the need for the preparation of more expert specialists in endodontics seems quite necessary in order to provide a higher level of oral care in Republic of Argentina.

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