VU QUANG HUNG

ASSESSMENT THE ROOT CANAL OF MANDIBULAR SECOND MOLAR, AND TREATMENT OUTCOME OF CAVITIES OF C-SHAPED ROOT CANAL PATIENTS

Specialization: Odontostomatology

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SUMMARY OF THE THESIS

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INTRODUCTION

Assessment of dental anatomy and the canal root of madibular second molar raises the concern of many scientists, aiming to conclude the size of crown, length of root, shape of root. This molar is characteristic of various shape and size. The C-shaped canal is common, and it appears both two sides in 70% patients. The differences of races and sexes are concerned by dentists, in order to raise the treatment quality. Additionally, the madibular second molar has strong masticating property, and plays a important role in mastication. This tooth also frequently get cavities of further side which closely relates to the third madibular molar with wrong deviation and canal damage. Therefore, it is challenging in cavities treatment, failures are frequent.

Even a large number of researches about not only canal anatomy, but also treatment of teeth, however, lacking of madibular second molar. Therefore, this research aims to: "Assessment the root canal of madibular second molar, and treatment outcome of cavities of C-shaped root canal patients"

1. Description of the second madibular root canal characteristic and the prevalence of C-shaped root canal.

2.   Assessment outcome of C-shaped root canal treatment in the mandibular second molar.

The significance of the Thesis. The C-shaped of the molars are variety, and un-synchronization with present dental tools. It leads to difficulties to completely clean and fill, resulting to recurrence. Therefore, study about shape and size of these teeth is very important in odontostomatology.

The contribution of the Thesis

1, Research of experiment:

- Description shape of 113 madibular second molars: number, shape of root and size.

- Conclusion number and shape of roots in 81 madibular second molars base on radiographic

- Assessment of number and shape of root canal in 32 madibular second molars C-shaped canal by the teeth crystallization and dying of India, and transverse slide of tooth roots.

2, Clinical assessment

- Researching the clinical characteristics of 56 madibular second molars in 56 patients who were diagnosed of irreversible pulpitis treated in National Hospital of Odonto-Stomatology.

- Evaluation prevalence of each C-shape type, number and working length of madibular second molars C-shaped.

- The high prevalence of filling treatment success after 1, 6 and 12 months

This is the first study about canal root and treatment outcome of madibular second molar C-shaped in Vietnam, also the science base for others study.

Structure of the Thesis.

Excluding of Introduction and Conclusion, there are 4 chapters:

Chapter 1: General description, 31 pages, Chapter 2: Objects and methodology, 17 pages, Chapter 3: Result, 24 pages, Chapter 4: Discussion, 36 pages. There are 26 tables, 5 graphs, 30 pictures, 140 references.

Chapter 1. BACKGROUND

1.1.2. Characteristic of root canal anatomy and shape of madibular second molar.

1.1.2.1. Number and shape of root:

Le Thi Huong showed the prevalence of madibular second molar with two roots (the near and the far one) is 61.4%. The others research show the form of 2 roots and 1 root double-shaped are most prevalence. However, there are differences between races also recorded. In Thailand, the two separated roots takes 90%. In

Myanmar, this number is 58.2%. In Turkey, 77.2% two roots and 22.8% one root.

The C-shaped root has been raised the concern, especially in Asia. The prevalence is 14.9% in Myanmar, 10% in Thailand, 31.5% in China. According to Le Thi Huong, the rate of one root is 37.3%, among this, 15 teeth (33.3%) is C-shaped. The madibular second molar with 3 roots is rare, in Le Thi Huong study (1.3%) and in Thailand (1.2%). However, this type is quite common in Eskimo.

1.1.2.2. Root canal shape from slide

In Le Thi Huong study, in the transverse slide through two roots tooth, the oval shape is majority (67.4%) of the proximal root. With the distal root, the rate of oval and round are similar. Clinically, total clean of oval shape type is challenging because the tool is not flexible enough for the curvature of root.

1.1.2.3. Root canal system of the madibular second molar.

In Le Thi Huong study of the madibular second molar, the prevalence of two canals of distal root is 100%, proximal root is 67.4%. The madibular second molar which has two canals in one root, gets higher prevalence in proximal root (32.6%), and distal root is absent. The two root canals is significantly higher than three one in researches conducted in Thailand, Myanmar and China. Walker showed the high prevalence of the madibular second molar with two root canals, also in the second upper molar and the second madibular small molar. Many authors proposed the significance of C shape root canal, it could help to clean and fill cavities.

The C shape root canal is separated in two main groups:

- Root canal spreading from base to apex, this type has only one apex Root canal has three or more separating roots, this type has more than two apexes.

Even many authors accept this classification. However, there is some difficulties with treatment. Fan et al supposed the impossibility

of understand completely the difference of C shape root canal. Gulabivala et al added 7 types in Vertucci classification. Chai and Thong classified to 12 different types vertically. Gao et al classified to 3 types of C shape root canal: Type I combination, Type II symmetric, Type III asymmetric. It also proved the complication of root canal.

The variety of C shaped root canal characterized for races. It is more common in Asian than European (2.7-7.6%). The Saudi Arabian is higher prevalence 91.6%). 31.5% root canal of Japanese is C shaped. Haddad et al showed the 19.1% of Lebanon, mean while Seo Park gave the number of 32.7% Korean with this structure. Le Thi Huong conducted research in Vietnam, concluded 33.3%.

1.1.3. Others classification of the madibular second molar root canal.
- Menton (1991) 3 types
- Fan et al (2004) 4 types

1.4. Treatment
- Sterilization
- Shaping and cleaning root canal
- Filling the root canal

Chapter 2. SUBJECTS AND METHODS
2.1 Subjects
2.1.1. Experimental study
Research included 113 madibular second molar which are removed, and conserved in Formol 10%, cleaned in NaOCl 5,25% solution in 24 hours.

2.1.1.1 Selection criteria
- The Vietnamese teeth were removed in Hai Phong Medical University Hospital, and National Hospital of Odonto-Stomatology .
- The madibular second molar were confirmed by dentist during removal.

- The teeth must to have body and intact root, the cavities were not deep in root canal.

- The teeth were filled of root canal.

2.1.1.2 Exclusion criteria

- Malformation of root

- Root canal treated

- Damaged by the cleaning process

2.1.1.3 Institute of research

Morphology Department, Institute 69, Ho Chi Minh Mausoleum High Command.

2.1.2 Clinical research

From 185 madibular second molar selected from patients, 56 ones of 56 patients were selected in both genders, ranging from 15 – 65 years old, from 11/2012 to 10/2017.

2.1.2.1. Selection criteria

- Irreversible pulpitis patients of madibular second molar, indicating for non-surgery treatment.

- The madibular second molar C shaped

- Filled teeth

- Non-deformity root

- Unable to recovery of cosmetic and mastication.

- Patient statute good enough

- Acceptable from the patients

2.1.2.2 Exclusion criteria

- Comorbidity diseases: Heart failure, nephritis, DM, psychology.

- Cracked and deformity teeth

- Periodontitis in the final stage or root destroyed more than a half.

2.1.2.3 Institute of research

Internal Odontology department of National Hospital of Odontology-stomatology.

2. Methodology

2.2.1 Study design

Preclinical and clinical intervention research.

2.2.2 Object size

2.2.2.1 Experimental study

Size: According Bhattacherjee (2012), to assess the differences before and after intervention, $n \geq 30$

Selection: The full criteria teeth were selected consecutively till enough number. In fact, 113 teeth were researched and there are 32 teeth C shaped root canal.

2.2.2.2 Clinical study

Size: According to formulation:

$$n = Z^2_{1-\alpha/2} \frac{p(1-p)}{d^2}$$

n = Object size.

α = Statistical signification.

$Z^2_{1-\alpha/2}$ = reliability coefficients, $Z^2_{1-\alpha/2} = 1.96^2$

P = Propotion of success after treatment (p = 90%).

d: The optimal accurate, select d = 0,9.

According this formulation, $n \geq 43$ (n = 42.7).

Selection: Filled criteria patients were selected to the determined amount. In fact, 56 teeth in 56 patients were slected.

2.4 Protocol of research

2.4.1. Experimental study

2.4.1.1. Protocol

- Teeth conserved in Formol 10% solution.
- Cleaning the teeth with NaOCl 5,25% solution.
- Drying and conserving the teeth in NaCl 0,9%\
- Radiograph and evaluate the number and quality of root.
- Root length measurement by Swiss Ruler, Major technique. Length of teeth were indicated from the top of crown to the bottom of

root canal. The ruler is measured parallel with the length of teeth. The length were recorded.

* Research in teeth with normal root

- Open the root canal

- Needle K number 08 or 10 were put till it exposed out of teeth (the loupe was deployed for detection)

- Radiograph according to Major technique (Teeth was put in rotating plate)

 * Research in teeth with root canal C-shaped

- In the demineralized and dying teeth

All teeth were put in HNO_3 5% in 7 days for demineralization. The proportion of teeth and solution was 1/20

+ The solution was changed after 24 hours continuously

+ Needle was used to check the demineralization whether needle can penetrate through.

+ Continuously clean the acid solution in 24 hours of running water

+ Elimination of water by 3 pots of alcohol, one hour for each pot.

Step1: Dying the root canal by Eozin. Eozin was filled in every root canal. Time for dying was 5 mins.

Result:

+ Root canal was from dark brown to black

+ Collagen was light to heavy pink

+ Photo of teeth after dying and crystallization

+ The shape and amount of roots were recorded

Step2: Filling the ethylic 70% in to root canal till no sediment and color unchanged in 10 mins.

Step3: Slice the teeth in to 5 determined slices

+ Slice 1: Through root, 1mm far from root

+ Slice 2: Through madibular quarter of root

+ Slice 3: Through the middle of the root

+ Slice 4: Through upper quarter of root

+ Slice 5: Through the neck of teeth.

- Photo of each slice.

Step4: Each slice was put on microscope

Step5: Read and analyzing the result

- Determination of root shape: round, oval, C

- Determination number of root canal, apical

- Base on the data, reanimation of root canal, and classification into 4 types

Type C1: Un-separated root canal without addition

Type C2: Semicolon shape, with α or β angle more than 60^0

Type C3: Two or three separated roots canal, with α or β angle less than 60^0

Type C4: Only one round or oval surface.

2.4.1.2 Experimental study records

- Number of roots

- Shape of roots

- Length of roots

- Number and shape of root canal with single one in apical radiograph

- Number and shape of root canal with C shape in crystalized teeth and dying according to Indian technique.

- Shape of root canal C shape in each slice

2.4.2. Clinical research

2.4.2.2 Protocol

- Local anesthetic

- Separate the treating tooth

- Use round drill, open the root canal, determination the entrance.

- Whether C shape root canal, patients were selected, the rest were received the same treatment.

- Protocol for C shape root canal teeth treatment

The difficulties were: complete clean, bleeding, un pleasant sensation.

+ K-Reamer 08 and 10 were used to find out the root canal

+ Determination of working length by measurement and radiograph

+ Needle K 15 or 20 were used to prepare root canal.

+ Non-sharp K file number 8, to find additional root and connecting branches.

+ Analgesic medication could be used in case of hurting patients.

+ Preparation of root canal were limited in 1/3-2/3 upper part.

+ EDTA for lubricant and NaOCl 3% solution for irrigating.

After preparation, ultrasound was used to vibrate and irrigate by NaOCl solution to clean the particle at the un-reached area.

C-shaped canal should be filled immediately, it is believed that $Ca(OH)_2$ was put until free pain, then filled.

- Check cone
- Fill with technique
- Radiograph to check
- Follow up

2.4.2.3. Record of treatment

- Determination of C shaped root canal
- Number and status of root canal, and working length of each
- Time for shaping the root canal
- Complication

2.5 Follow up and results assessment after treatment

2.5.1. Assessment of results. Based on five principles of Schilder

2.5.2 Assessment of results after first month,sixth month,and 12th month. Based on signs, symptoms and radiograph, the results were classified into 3 categories: success, doubtful, and fail. The doubtful patients were followed up. The failed patients were received next treatment.

2.6 Statistical tool. Software Epi-Info 6.04 of CDC and WHO 2001. Chi – Square with 95%CI.

2.7 Ethics of research

- Approved by ethics council
- Experimental study was conducted before clinical
- Clinical study accorded moral principles
- Precise of data
- Personal information security was confirmed

Chapter 3. RESULTS

3.1 Characteristics of the madibular second molar root canal in experimental study

3.1.1. Characteristics of general view

*3.1.1.1 Prevalence of root number.*The highest prevalence was 2 roots, the lowest was 3 roots: 2 roots 67.3%, one root 30.1% and 3 roots 2.6%.

3.1.1.3. Shape of root. The normal root canal (71.7%) were significantly higher than the C shaped one (28.3%). C shaped were common in one root teeth and no case in 3 roots. C shaped took 85,3% of one root teeth and 3.9% of two roots.

3.1.2 Characteristic of root canal in madibular second molar with normal root

3.1.2.2. Number of root canal in the madibular second molar with normal root. The highest proportion was 2 root canals (50.6%), the lowest was 4 root canals (1.2%). In one root group, the one, two, three canals were 40%, 40% and 20% respectively. In two roots group, the two, three, four canals were 53.4%, 5.2%, and 1.4% respectively. In three roots groups, 100% three canals.

3.1.2.3. Classification root canal of the madibular second molar according to Vertucci

According to Vertucci, this research only met the root canal type I, II, III, IV, and V. there was no type VI, VII and VIII. The highest prevalence was type I, and the lowest was V. In one root group, the canal type I and II were 40% and IV was 20%. In two roots group: the proximal canal type I was highest prevalence 35.6%, and rarely type V (8.2%). The distal canal type I was 86.3%, rarely type IV was 1.4%. In three roots, 100% type I.

3.1.3 Characteristics of root canal C-shaped in the madibular second molar.

3.1.3.1. Number and shape of root canal in crystalized and dying teeth

   * Number of root canals of C shaped root canal

Table 3.8. The prevalence of canals and roots number

Canal	1 root		2 root		Total	
	n	Proportion(%)	n	Proportion(%)	n	Proportion(%)
1 canal	10	34.5	0	0.0	10	31.2
2 canals	18	62.1	1	33.3	19	59.4
3 canals	0	0.0	2	66.7	2	6.3
4 canals	1	3.4	0	0.0	1	3.1
Total	29	100.0	3	100.0	32	100.0

In the C shaped root canal, the highest prevalence was 2 canals 59.4% and lowest was four canals 3.1%. In group one root, the proportion of one canal, two canals, three canals and four canals were 34.5%, 62.1%, 0.0% and 3.4% respectively. In group two roots, there was no tooth with 4 canals, 3 canals took 66.7%, 2 canals took 33.3%.

3.1.3.2. Classification of root canal figure in C shaped teeth according to Vertucci

Table 3.10. Classification of root canal with C shaped according to Vertucci

Type	n	Proportion (%)
Type I	10	31.2
Type II	1	3.1
Type III	8	25.0
Type IV	5	15.6
Type V	6	18.8
Type VI	0	0.0
Type VII	0	0.0
Type VIII	2	6.3

In C-shaped group, the most common was type I (31.2%), the following was type III (25%), type V (18.8%), type IV (15.6%), type VIII (6.3%), type II (3.1%) and there was no tooth with type VI and VII.

Table 3.12. Figure of root canal in C shaped

Shape of root canal	n	Proportion (%)
C shaped	30	93.7
Oval or round	2	6.3

In 32 teeth C shaped root, the C shaped root canal was significantly higher than others. 30 teeth C shaped root canal (93.7%), round and oval (6.3%)

3.1.3.3 Classification of root canal figure of C shaped

Table 3.13. Classification of C shaped root canal according to Fan et al

C shaped root canal	n	Proportion (%)
C1	22	68.7
C2	6	18.7
C3	2	6.3
C4	2	6.3

From this table, the root canal C1 shape was the most popular, the most uncommon was C3 and C4. The C1, C2, C3, C4 took 68.7%, 18.7%, 6.3% and 6.3 % respectively

3.2. Clinical characteristic and treatment results in the madibular second molar C shaped root canal

3.2.1. Clinical characteristics of objects

3.2.1.1. The distribution of gender and age

   - Age: The most common range was 31-45 years old who accounted for 50.0%. The others were 15-30 and 46-65 years old took 30.4% and 19.6% respectively.

   - Gender: Female was more than male, 31/56patients (55.4%). 44.6% patients were male.

3.2.1.2 The distribution of causes. The most common of irreversible pulpitis was cavity 83.9% and the others were lesser 5.4%.

3.2.2. Characteristic of the madibular second molar C shaped root canal.

3.2.2.1. The entrance of C shaped root canal

   Table 3.17 The distribution entrance of C shaped root canal in clinical

Type	n	Proportion (%)
C1	35	62.5
C2	13	23.2
C3	8	14.3
Total	56	100.0

   The most common was C1 (62.5%), the following was C2 (23.2%) and the most uncommon was C3 (14.3%).

3.2.2.2. The amount of root canal

   Table 3.18 The distribution of root canal number

Number of root canal	n	Proportion (%)
1 root canal	15	26.8
2 root canals	31	55.3
3 root canals	9	16.1
4 root canals	1	1.8
Total	56	100.0

   From this table, patient with 2 root canals who accounted for 55.3% was the most popular, patient with 1 root canal was 26.8%, patient with 3 root canals was 16.1. And the most uncommon was patient with 4 root canals who accounted for 1.8%.

3.2.2.3. Working length of the canal root

In our research, patients with working length of one canal was longer than the patients with multiple root canals. In tooth with multiple root canals,working length of the proximal root canal was higher than the distant root canal.

- The average length of one canal was 18.87 ± 1.17 mm.

- Tooth with 2 root canals, , the average length of proximal was 18.57 ± 2.14 mm and and the distal was 18.34 ± 1.77 mm.

- Tooth with 3 root canals:

+ Tooth with 2 lateral proximal canals and 1 distal root canal: the length of lateral proximal canal was 18.51 ± 2.09 mm, and internal proximal canal was 18.46 ± 1.77 mm and the distal was was 18.27 ± 1.13 mm.

+ Tooth with 1 proximal root canal and 2 distal root canals: the working length of proximal root canal was 18.5 mm, the working length of lateral and internal distal root canal was 17 mm.

- Tooth with 4 root canals: the working length of lateral proximal root canal was 17 mm, the working length of internal proximal root canal was 17.5 mm, , the working length of lateral and internal distal root canal was respectively 15 mm and 16 mm.

3.2.3. Results of treatment

3.2.3.1. Results of canal preparation

 - Time of canal preparation

Time of canal preparation uas the shortest in tooth with 1 and 4 root canals. Average the time was 8.34 ± 2.27 mins in tooth with 1 root canal, 15.66 ± 4.60 mins in tooth with 2 root canals, 18.52 ± 3.89 mins in tooth with 3 root canals and 19.74 mins in tooth with 4 root canals. Average time of preparation with one canal was 7.65 ± 2.25 mins.

 - Complications of duration of canal preparation

Table 3.22. Complications of duration of canal preparation

Complications	n	Proportion (%)
Instrument broken	0	0.0
Perforation	2	3.6
Malformation of canal	3	5.,4
None	51	91.0

In this table, there were 5 cases with complications in duration of canal preparation in which 3.6% patients with perforation and 5.4% patients with malformation of canal.

3.2.3.2. The radiograph result after fill

Radiograph right after filling showed that, the proportion of good filling was significantly higher than the medium and poor ones. Rate of good and medium and poor filling was respectively 91.0%, 5.4% and 3.6%.

3.2.3.3. Clinical outcome results

After 1 month*: Rate of success patients was higher than rate of doubt and failure groups. Rate of success patients accounted for* 87.5%; in doubtful group was 12.5% and no patient sufferred from failure.

After 6 months, *rate of success patients accounted for 89.3% was higher than rate of* doubtful group (8.9%) and *failure group (1.8%).*

12 months of fill, *rate of success patients accounted for the highest with 92.8%; rate of* doubtful group was 5.4%. And it was the lowest that rate of *failure group was 1.8%.*
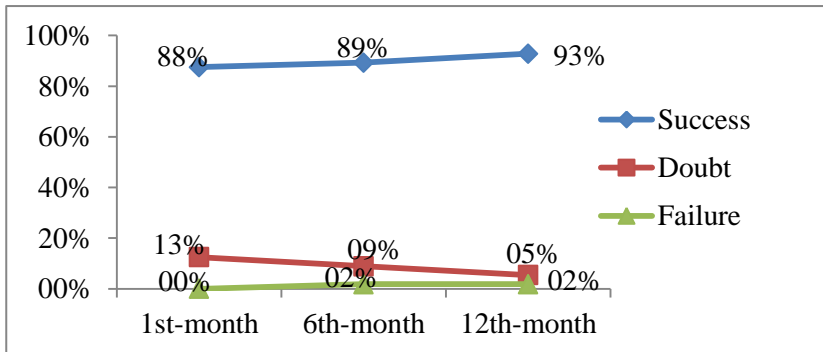

Figure 3.5. *The radiograph result after fill*

Chapter 4. DISCUSSION

4.1. *Characteristics of the madibular second molar root canal in experimental study*

4.1.1. Characteristics of general view

4.1.1.1. **Root number**

In our research, The highest prevalence was 2 roots, the lowest was 3 roots: 2 roots 67.3%, one root 30.1% and 3 roots 2.6%. There were 76 teeth with two roots that accounted for 67.3% and 34 teeth with one root that was 30.1%. Rate of patient with 3 roots only was 2.6% (3/ 113 patients)

4.1.1.3. **Shape of root**

The normal root canal (71.7%) were significantly higher than the C shaped one (28.3%). C shaped were common in one root teeth and no case in 3 roots. C shaped took 85,3% of one root teeth and 3.9% of two roots. C shaped root was found the most in teeth with one root and two roots. Specially, The normal root canal with C shaped was met in teeth with one root and two roots in our research. There were 29 teeth with C-shaped in 34 one-root teeth and 3 teeth with C-shaped in 76 two-root teeth that C-shaped was in distal root. However, Le Thi Huong and Yang et al. showed that The normal root canal with C-shaped only was seen in teeth with one root.

4.1.2. *Characteristic of root canal in madibular second molar with normal root*

4.1.2.2. *Number of root canal in the madibular second molar with normal root.*

The highest proportion was 2 root canals (50.6%), the lowest was 4 root canals (1.2%). In one root group, the one, two, three canals were 40%, 40% and 20% respectively. In two roots group, the two, three, four canals were 53.4%, 5.2%, and 1.4% respectively. In three roots groups, 100% three canals

We studies in 81 teeth with root canal in the madibular second molar with normal root. The results showed that root canal in the madibular second molar with normal root can be one or muliple

canals in which two-canal teeth was the highest (accounted for 50.6%) and four-canal teeth was the lowest (accounted for 1.2%), one-canal teeth was 45.7% and three-canal teeth was 2.5%. Rate of root with one canal was higher than rate of root with muliple canals. In teeth with one root there 2/5 teeth with one-canal, 2/5 teeth with two-canals and 1/5 teeth with three-canals. All teeth with three-canals had only one root. In our research, number of root canal in madibular second molar with normal root was not large, the results can't be significant. So that, in teeth with two root, there was number of canals (from two to four canals) in each root significantly. Most of distal root had one canal. And there were 56.2% teeth with one-canal and 43.8% teeth with two-canals in proximal root. In 73 teeth with two root, there were 39 two-canal teeth (one proximal root and one distal root), 33 three-canal teeth (31 teeth with two proximal canal root and one distal canal root; 02 teeth with one proximal canal root and two distal canal root). There was one teeth with four canal (two proximal canal root and two distal canal root)

4.1.2.3. Classification root canal of the madibular second molar according to Vertucci

According to Vertucci, this research only met the root canal type I, II, III, IV, and V. there was no type VI, VII and VIII. The highest prevalence was type I, and the lowest was V. In one root group, the canal type I and II were 40% and IV was 20%. In two roots group: the proximal canal type I was highest prevalence 35.6%, and rarely type V (8.2%). The distal canal type I was 86.3%, rarely type IV was 1.4%. In three roots, 100% type I.

Trong nghiên cứu này, chúng tôi chia hình thái OT RHLT2HD thành 8 dạng theo phân loại của Vertucci. Kết quả nghiên cứu ở 81 răng có chân đơn thuần cho thấy, không gặp trường hợp nào có ống tủy loại VI, VII và VIII, hình thái OT hay gặp nhất là OT loại I và ít gặp nhất là OT loại V. Ở các răng 1 chân, 40% số chân răng chỉ có 1 OT duy nhất chạy từ buồng tủy và ra khỏi chân răng bằng 1 lỗ chóp (OT loại I), 2/5 trường hợp (chiếm 40%) có 2 OT từ buồng tủy sau đó nhập thành 1 và đi ra khỏi chân răng bởi 1 lỗ chóp (OT loại II), 1 trường hợp (chiếm tỉ lệ

20%) có 3 OT, sau đó 2 ống nhập lại làm 1 và cùng với OT còn lại đi ra khỏi chân răng bằng 2 lỗ chóp, đối chiếu với phân loại của Vertucci, chúng tôi xếp trường hợp này vào hình thái OT loại IV. Ở các răng 3 chân, tất cả các chân đều có 1 OT từ buồng tủy và ra khỏi chân răng bằng 1 lỗ chóp (OT loại I). Trong khi đó, hình thái OT phức tạp hơn được thấy ở các răng 2 chân. Trong số 73 răng 2 chân, 35,6% các chân gần và 86,3% các chân xa có OT loại I, ống tủy loại II được thấy ở 9,6% các chân gần và 2,7% các chân xa, ống tủy loại III gặp ở 20,6% các chân gần và 9,6% các chân xa (với 1 OT từ buồng tủy sau đó chia làm 2 OT rồi nhập lại thành 1 OT và ra khỏi chân răng bởi 1 lỗ chóp), tỉ lệ OT loại IV chiếm 26% ở các chân gần và 1,4% các chân xa, OT loại V (với 1 OT từ buồng tủy sau đó chia thành 2 OT và ra khỏi chân răng bởi 2 lỗ chóp riêng biệt) chúng tôi gặp ở 6/73 chân gần (chiếm tỉ lệ 8,2%) và không gặp ở chân xa.

4.1.3. Characteristics of root canal C-shaped in the madibular second molar

4.1.3.1. Number and shape of root canal in crystalized and dying teeth

In our research, there were 32 root canal in crystalized and dying teeth. Those teeth were filled India ink to observe and count number and shape of canal. This method was used by researchers. In the results, C shaped root canal was seen in one, two, three or four canal teeth in which the highest prevalence was 2 canal-teeth accounted for 59.4%, and the lowest was four canals 3.1%. In group one root, the proportion of one canal, two canals, three canals and four canals were 34.5%, 62.1%, 0.0% and 3.4% respectively. In group two roots, there was no tooth with 4 canals, 3 canals took 66.7%, 2 canals took 33.3%. Classification of C-shape canal was complicated. According to Vertuccci – 1984 there were 6 types, in which the most common was type I (31.2%), the following was type III (25%), type V (18.8%), type IV (15.6%), type VIII (6.3%), type II (3.1%) and there was no tooth with type VI and VII.

4.1.3.3. Classification of root canal figure of C shaped

In C-shaped group, the most common was type I (31.2%), the following was type III (25%), type V (18.8%), type IV (15.6%),

type VIII (6.3%), type II (3.1%) and there was no tooth with type VI and VII.

3.1.3.3 Classification of root canal figure of C shaped

There were many proposed classification of C-shaped canal.However, no authority seem put forward adequate classification including all subtype histopathology. Until 1990, Maning was the first person proposed C shaped root canal classification. Since then in Melton classification there were three types C shaped root canal. Fernandes et al said that Melton classification was not clearly. Both of Maning and Melton only put forward C shaped root canal, but they did not deal with C shaped root canal with length of root teeth. Other classification was pushlished by Al-Fouzan, Gao et al, Min et al. ect... In 2004, Fan classification divided five canal shapes including three type of C shape with C1,2,3; oval or circle shape (C4) and thick root teeth (C5). This classification seem be fairy completeness and was applied in clinical practice. In our research, the root canal C1 shape was the most popular, the most uncommon was C3 and C4. The C1, C2, C3, C4 took 68.7%, 18.7%, 6.3% and 6.3 % respectively

4.2 The clinical and result characteristics

4.2.1. The clinical characteristics

4.2.1.1 The distribution of age and gender

Female was more prevalence than male (31 females 55.4% and 25 males 44.6%). The most common age was 31-45 years old, 50.0%; and the others groups 15-30 years old and 46-65% were 30.4 % and 19.6%. The distribution of age in each gender, the most prevalence in both gender was 31-45 years old (14 males and 14 females, 25 % for each). The proportion of both gender were lowest from 46 to 65 years old (female 14.3% and male 5.3%). Using the statistical formulation, there was no difference in the rate of both gender in each age group.

In this study, the patients with madibular second molar C shaped, irreversible pulpitis were selected, therefore the proportion could be different in two gender, and age groups. However, we supposed the proportion did not depend on age and gender.

4.2.1.2 The distribution of causes

There were many causes of irreversible pulpitis: cavity, trauma… The most common cause was cavity, 47/56 teeth (83.9%). Most of cavities was distal surface (76.8%). The most reason was disorientation of the madibular third molar. It could be explained by the disorientation of this teeth was commonly distal trend. Others, the cavities could be in the lateral (10.7%) or masticate (12.5%) surfaces. There was no cavity in the proximal surface.

4.2.2. The characteristics of the C shaped root canal of madibular second molar in clinical.

4.2.2.1 The entrance of C shaped root in clinical

Clinically, after opening the canal, it could be checked directly under microscope. Investigating 56 teeth, most of them were C shaped entrance. , the lesser were semicolon and semi C shaped. According to Fan et al classification, there were 62.5% type C1, 23.2% type C2, 14.3% type C3. In this study, only C shaped entrance was identified, the longitudinal C shaped was not found. However, we did not clinically assess the C shaped, it was conducted experimentally. Even the results from both type was fairly similar.

4.2.2 The number of root canal

From 56 madibular second molars C shaped, most of them were 2 canals (55.3%), one canal (26.8%), 9 teeth had 3 canals (16.1%) and only one tooth had 4 canals (1.8%). In multi canals teeth, distal root, 95.1% had one canal, only 4,9% had two canals. In the proximal root, 78% had one canal and 22% had two canals. In this study, there were 31 teeth with two root canals, each for one root; 9 teeth with 3 canals (8 teeth with 2 canals in proximal root, and 1 tooth with one canal in proximal root). There was one tooth with 4 canals, two for each root.

The number of teeth with 2 and 4 canals in clinical were quite similar with in experiment. However, the one and three canals were contrast, higher with the three canals, and madibular with the one canal. But the difference wasn't so far.

4.2.2.3Working length of root canal

In this study, the length was calculated by Propex II machine and apical radiograph. The results were the one canal was significantly higher than multiple canals. The average length of one canal was 18.87 ± 1.17 mm. In the multiple root canal, the working length of proximal were higher than distal. In two canals, the average length of proximal was 18.57 ± 2.14 mm, and the distal was 18.34 ± 1.77 mm. In 9 teeth with three canals (8 ones with 2 proximal), the length of lateral proximal canal was 18.51 ± 2.09 , and internal proximal canal was 18.46 ± 1.77 mm and the distal was 18.27 ± 1.13 mm. The rest wasn't found comparative result.

4.2.3 Treatment results

4.2.3.1 Preparation results

- ***Time: It*** increased according to number of canal. The average time of 1, 2, 3 canals was 8.34 ± 2.27 mins, 15.66 ± 4.60 mins and 18.52 ± 3.89 mins, respectively. In only one tooth with four canals, the average time was 19.74 mins. The general average time for 108 canals (56 teeth) was 7.65 ± 2.25 mins. In conclusion, the difficulties of preparation were place and multiple canals of teeth.

- Complication: There were 5 cases with perforation or malformation inside canal. The complication was reduced by needle number 8 and 10 to preassessment. Each tooth was prepared by one different Protaper, according to instruction of manufacture. The young and middle age patients with wide canal was common, therefore there was no case of instrument broken. However the variety of canal leads easily to complication.

In this research, there were 3 cases (5,4%) with malformation of canal. The common places were middle third or lowest third, which are more convex. According to Ngo Thi Huong Lan, although the renovation of Protaper, it isn't flexible enough dentist desire. In combination with disorientation of instrument, the perforation could happen.

In this study, there were two perforated cases (3,6%) in the proximal canal of 2 canals teeth and 3 canals teeth. The locations

were commonly in the apical and madibular third. Ngo Thi Huong et al showed the better outcome for apical perforation. Howerver, one case had to be received 6 months of failed treatment.

4.2.3.2 The radiograph result after fill

Radiograph right after filling, the proportion of good filling was significantly higher than the rest. 91,0% teeth was well filled in radiograph, 3 cases of this had discontinuous canal resulted by malformation preparation. Even these case was well filled in radiograph, it was still classified in average group. Two perforated cases were reformed and filled, classified in bad outcome, and keep following up.

4.2.3.2. Clinical outcome results

One month after treatment, 87.5 cases were treated successfully, there was no fail. There were 7 patients who had slight pain during mastication. However absence of swelling and lesion in radiograph, they were classified in to doubtful group.

After 6 months, the one doubtful patient could be archived normal mastication without pain, and was classified in success group. The rest of slight pain patients after one month were followed for next time. In this group, one patient had lesion in apical region, it was concluded as fail. Male 22 years old patient diagnosed with irreversible pulpitis of forty seventh. It was entrance C shaped (C1), 4 canals, 2 proximal and two distal. During preparation at the lowest third, the perforation happened. It was re-prepared and put calcium hydroxide in one week, then filled. The outcome in radiograph and clinical were good. After one month, it was classified in doubtful group because of pain. Lesion appeared after 3 months leading to fail result even 6 months of antibiotics. The tooth was removed finally.

After 12 months of fill, two doubtful cases recorded no pain and arranged in success group, fail case was mentioned previously. In conclusion, 92,8% cases were success, 3 doubtful cases had to be followed up.

CONCLUSION

After researching 113 madibular second molars with 32 C shaped root canal in experimental, and 56 ones in clinical. There are some conclusions:

1. Experimental research results

1.1. Characteristic of madibular second molar

- The two roots was most common that accouted for 67.3%
- The normal root (71.7%) was more common than C shaped root (28.3%)

1.2. Characteristics of the madibular second molar root canal

Normal root canal

- The prevalence of 2 canals was the highest that accouted for 50.6%
- The most common was type I. One root 40%, two roots: the proximal 35.6%, distal 86.3%.

C shaped root canal

- In crystallization and dying teeth: 59.4% root of madibular second molar C shaped had 2 canals. Type I was prominent (31.2%)
- Root canal shaped in slice: the C shaped root canal (93.7%) was more common than oval or round.
- The most common of root canal was C1 that accounted for 68.7%

2. Clinical features and treatment results

2.1 Clinical features

- Male was more than female
- The common range of age was 31-45 years old that accounted for 50%
- The highest prevalence cause was cavity 83.9%

2.2. The clinical characteristics of C shaped root canal in madibular second molar

- Type C1 was the most common 62.5%
- Two root canals was more common. 55.3%
- The working length of teeth with one canal (18.87 ± 1.17mm) was higher than multiple canals. In multiple canals teeth, the length

of proximal canal (18.57 ± 2.14mm) was longer than distal (18.34 ± 1.77mm).

2.3. Treatment result

- The preparation time were shortest in one canal, and longest in four canals teeth. The average preparation time for one, two, three, four canals were 8.34 ± 2.27 mins, 15.66 ± 4.60 mins, 18.52 ± 3.89 mins, 19,74 mins, respectively. The average preparation time for one general canal 7.65 ± 2.25 mins.

- In radiograph, 91% was good outcome
- Clinically:

After one month, the prevalence of success was 87.5%

After 6 months, the prevalence of success was 89.3%

After 12 months, the prevalence of success was 92.8%

PROPOSAL

The Vietnamese teeth was smaller than European, American and African. However, it is similar with Asian, therefore the material should be noted.

The C shaped root canal of madibular second molar was common in Vietnamese. Hence, if it is doubtful in radiograph, the canal should be opened, and determine the type. Then, carefully chose the tools, instrument for preparation.

It also requires more researches of root canal feature of Vietnamese. It helps to conclude the general characteristics for diagnosis and treatment.

It demands more research of C shaped root canal for treatment and innovative in conservative treatment.

LIST OF PUBLICATIONS RELATING TO THE THESIS

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