The analysis of pathogenic microorganism distribution in infected root canal.

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Abstract

Our objective is to analyze the constitution and drug resistance of pathogenic microorganisms in infected root canals. 69 patients with chronic periapical periodontitis were selected, the tooth root canals of which were collected. There were 15 cases (group A) with root canal infection after root canal treatment failure, 18 cases (group B) with root canal infection after dental crown restoration, 16 cases (group C) with root canal infection after pulpectomy and 20 cases (group D) with root canal infection after no treatment. The detection rates of bacteria in group A, B, C and D were 93.33%, 94.44%, 87.50% and 90.0% respectively, the detection rates were significantly higher than the detection rates of archaebacteria, which were statistically different (P<0.05); the detection rates of three actinomycetes including *A. viscosus, A. naeslundii* and *A. israelii* were 80%, 20% and 26.67% in group A which were all higher than group B, C and D; the detection rate of *Enterococcus faecalis* in group A was 73.33% which was obviously higher than group B, C and D, there were significant differences between groups (P<0.05). There were 8 cases with symptoms in mixed infection group with percentage of 80%, 26 cases with symptoms in the simple bacterial infection group with percentage of 49.06%, 2 cases with symptoms in the simple archaebacterial infection with percentage of 33.33%, the occurrence rate of symptoms in the mixed infection group was obviously higher than the other groups and there were significant differences between groups (P<0.05). After the root canal is infected by microorganism, there may be with symptoms or without symptoms. The infection microorganisms are mainly actinomycetes and *Enterococcus faecalis*, there are different infection microorganisms in different types of root canal infections.

Introduction

Many researches have proven that the infection by microorganism in root canal [1-4] is the main reason of periapical inflammation [5-8] and pulpitis [9-14]. Due to the complexity of root canal anatomy and diversity of microorganism in periapical tissue, the category, constitutional features and state of existence of microorganisms in root canal are still not clear. In this study, 69 patients with chronic periapical periodontitis in our city during October, 2012-October, 2013 were selected, the tooth root canals of which were collected to detect the species composition of microorganism and the clinical symptoms, and further provide an objective and reliable basis for clinical treatment.

Materials and Methods

General data

69 patients with chronic periapical periodontitis in our city during October, 2012-October, 2013 were selected, the tooth root canals of which were collected. There were 15 cases (group A) with root canal infection after root canal treatment failure, 18 cases (group B) with root canal infection after dental crown restoration, 16 cases (group C) with root canal infection after pulpectomy and 20 cases (group D) with root canal infection after no treatment. Among 69 cases, there were 41 male cases and 28 female cases, the age was 29-84 with the average age of 41.7 ± 9.7.

Inclusion and exclusion criteria

All patients included were conformed to the diagnostic criteria of chronic periapical periodontitis; and patients with systematic disease, periodontal probing depth >3 mm, poor wet insulation effect, serious dental crown damage and antibiotics treatment within 1 month were excluded.

Clinical manifestations

6 cases with root canal infection after root canal treatment had symptoms including swelling, spontaneous pain and occlusal pain et al. physical examination showed sensitive to percussion. 18 cases of 20 patients with root canal infection after no treatment had symptoms including swelling, spontaneous pain and occlusal pain. Physical examination showed sensitive to percussion and oral examination showed

there was carious cavity, jack-knifing and sub issue, but no medullary cavity break-through. 7 cases with root canal infection after dental crown restoration had symptoms including swelling, spontaneous pain and occlusal pain et al, physical examination showed sensitive to percussion. 5 cases with root canal infection after pulpectomy had symptoms including swelling, spontaneous pain and occlusal pain, physical examination showed sensitive to percussion. There was sinus tract in all patients; x-Ray showed that there was bone destruction area around periapical area.

Sample collection and culture methods

Before sample collection, 1% potassium permanganate was used for gargling and the diseased tooth was disinfected by iodine tincture. Sterile nerve broach was used to entwist in the root canal for 30 seconds, after being taken out, the terminals of cotton broaches were put in the transfer bottle containing with hioglycollate medium. The collected samples were diluted and the concentrations were calculated. According to the cultured pathogenic microorganisms, anaerobic culture medium, selective medium of bacteroides, *Actinomycetes* culture medium, *Peptococcus* culture medium, *Peptostreptococcus* culture medium and aerobic bacteria culture medium were used respectively. The culture environment, temperature and time were selected according to the demands of different pathogenic microorganisms.

Separation of pathogenic microorganisms

The colonial morphologies of cultured pathogenic microorganisms were observed, and the colonies were smeared for microscopic examination to observe the morphology of microorganisms and the staining style.

Observational indexes

The detection condition of bacteria and archaebacteria in different infected root canals were observed.

The microorganism detection condition in different infected root canals.

The correlation between different infection type and clinical symptoms were observed.

Statistical analysis

All data were analyzed by SPSS software (19.0; SPSS, Inc., Chicago, IL, USA), the measurement data were presented as $\bar{x}$ ± S and analyzed by t test, the enumeration data were analyzed by x^2 test, P<0.05 was considered as statistically significant.

Results

The comparison of detected bacteria and archaebacteria

In the results of bacteria and archaebacteria detection in 4 different infected root canals, the detection rates of bacteria in group A, B, C and D were 93.33%, 94.44%, 87.50% and 90.0% respectively, the detection rates were significantly higher than the detection rates of archaebacteria, which were statistically different (P<0.05). As shown in Table 1.

Table 1. *The comparison of detected bacteria and archaebacteria in 4 different infected root canals [case, %].*

Group	n	Archaebacteria		Bacteria	
		Positive	%	Positive	%
Group A	15	2	13.33	14	93.33
Group B	18	6	33.33	17	94.44
Group C	16	3	18.75	14	87.50
Group D	20	5	25.0	18	90.0
In total	69	16	23.19	63	91.30*

Note: * means P<0.05 when compared with archaebacteria.

The microorganism detection condition in different infected root canals

In the results of microorganism detection in 4 different infected root canals, the detection rates of three actinomycetes including *A. viscosus*, *A. naeslundii* and *A. israelii* were 80%, 20% and 26.67% in group A which were all higher than group B, C and D; the detection rate of *Enterococcus faecalis* in group A was 73.33% which was obviously higher than group B, C and D, there were significant differences between groups (P<0.05) (Table 2).

The correlation between microorganism infection and clinical symptoms

In the analysis of infection and clinical symptoms, there were 8 cases with symptoms in mixed infection group with percentage of 80%, 26 cases with symptoms in the simple bacterial infection group with percentage of 49.06%, 2 cases with symptoms in the simple archaebacterial infection with percentage of 33.33%, the occurrence rate of symptoms in the mixed infection group was obviously higher than the other groups and there were significant differences between groups (P<0.05). As shown in Table 3.

Table 2. *The comparison of microorganism detection in different infected root canals [strain, %].*

Group	n	*Enterococcus faecalis*	Actinomycetes			
			A. viscosus	*A. naeslundii*	*A. israelii*	*A. radicident*

The analysis of pathogenic microorganism distribution in infected root canal.

Group A	15	11 (73.33)*	12 (80.0)*	3 (20.0)	4 (26.67)*	1 (6.67)
Group B	16	3 (18.75)	3 (18.75)	0 (0.0)	1 (6.25)	2 (12.5)
Group C	18	10 (55.56)	3 (16.67)	2 (11.11)	1 (5.56)	0 (0.0)
Group D	20	1 (5.0)	2 (10.0)	0 (0.0)	0 (0.0)	0 (0.0)
In total	69	25 (36.23)	20 (28.99)	5 (7.25)	6 (8.70)	3 (4.35)

Note: * means P<0.05 when compared with group B, C and D.

Table 3. *The correlation between microorganism infection and clinical symptoms [case, %]*

Infection group	n	With symptoms		Without symptom	
		Case	%	Case	%
Simple bacterial infection group	53	26	49.06	27	50.94
Simple archaebacterial infection group	6	2	33.33	4	66.67
Mixed infection group	10	8	80.0*	2	20.0
In total	69	36	52.17	33	47.83

Note: * means P<0.05 when compared with simple bacterial infection and simple archaebacterial infection group.

Discussion

In the normal condition, the oral microorganisms are mainly normal oral bacteria flora. When the mouth is infected by opportunistic infection microorganism, there are a series of oral diseases, including root canal infection [15-19] and pulp infection [20-24]. Strictly anaerobes are the main components of opportunistic infection flora in oral infection, the infection ways are mainly semi-specific and mixed infection. Oral infection is the mainly reason of tooth loss in middle age and old age people [25-27]. After microorganism infection in root canal, decomposer of necrotic dental pulp and toxin secreted by microorganisms enter from root canal into periapical tissue to cause inflammation of periapical tissue, complicating with local bone absorption.

The detection method for detecting pathogenic bacteria in root canal infection is tedious which takes a long time. And after onset, the toothache can significantly affect the life of patients. After admission, doctors usually apply antibiotics empirically for treatment [18,28]. Thus, to study the constitution of pathogenic bacteria in infected root canals caused by different reasons is beneficial to direct the selection of appropriate antibiotics for patients with root canal infection in this region or this hospital, which can improve the therapeutical effect and decrease the resistance of pathogenic microorganisms [29,30]. In this study, we cultured the infected root canal samples from patients with root canal infection after root canal therapy failure, dental crown restoration, pulpectomy failure and no treatment. the detection rates of bacteria in group A, B, C and D were 93.33%, 94.44%, 87.50% and 90.0% respectively, the detection rates were significantly higher than the detection rates of archaebacteria, which were statistically different (P<0.05). The results indicate that besides conventional microorganism infection, archaebacterial infection in root canal should not be ignored and archaebacteria exists in different types of infected root canals. In the detection of the main infection microorganisms in different types of infected root canals, the detection rates of three actinomycetes including *A. viscosus*, *A. naeslundii* and *A. israelii* were 80%, 20% and 26.67% in group A which were all higher than group B, C and D; the detection rate of *Enterococcus faecalis* in group A was 73.33% which was obviously higher than group B, C and D, there were significant differences between groups (P<0.05). The results indicate that actinomycete is the main microorganism in root canal infection after treatment failure, meanwhile, the detection rate of *Enterococcus faecalis* is significantly increased after treatment failure.

In the analysis of correlation between clinical symptoms and infected microorganisms, there were 8 cases with symptoms in mixed infection group with percentage of 80%, 26 cases with symptoms in the simple bacterial infection group with percentage of 49.06%, 2 cases with symptoms in the simple archaebacterial infection with percentage of 33.33%, the occurrence rate of symptoms in the mixed infection group was obviously higher than the other groups and there were significant differences between groups (P<0.05). The results showed that archaebacterial and bacteria had synergetic pathogenic effects, the occurrence rates of clinical symptoms including swelling, spontaneous pain and sensitive to percussion were increased.

In conclusion, after the root canal is infected by microorganism, there may be with symptoms or without symptoms. The infection microorganisms are mainly actinomycetes and *Enterococcus faecalis*, there are different

infection microorganisms in different types of root canal infections.

Acknowledgements

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