Caspian J of Dent Res

Original Article

The effect of different irrigants and intra canal dressing on sinus tract closure

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Received: 7 Oct 2014 Accepted: 21 July 2015

Abstract

Introduction: Antimicrobial activity of irrigants and interappointment intracanal dressing is an important consideration in endodontics**.** The aim of this study was to evaluate the clinical efficacy of chemomechanical preparation of the necrotic canals with different irrigants and intra canal dressing in the control of root canal infection and sinus tract closure.

Materials &Methods: In this study, 65 patients with sinus tract were treated. They were randomly divided into 4 groups. Sodium hypochlorite (NaOCl) and chlorhexidine (CHX) was used as the irrigation solutions in the group one and two, then the canals were filled. In group three, after irrigation with NaOCl, Ca (OH) 2/sterile Saline was used as intra canal medicament, and similar to group three Ca (OH) 2/CHX was used in group four after irrigating by CHX. After 7 days, the intra canal paste was removed and the canals were filled. The sinus tract closure was followed up within 7, 14, and 21-day intervals. The data were analyzed using Chi Square and Kruskal-Wallis statistical tests.

Results: The highest mean time of sinus tract closure was for Ca $(OH)_2$/sterile Saline and the lowest was for Ca$(OH)_2$/CHX .The differences of sinus tract closure between group 2&4 (p=0.04), group 3&4 (p=0.004). Groups were statistically significant.

Conclusion: It was concluded that Ca $(OH)_2$/CHX paste as intra canal dressing has good clinical efficacy in the control of root canal infection and sinus tract closure.

Keywords: Calcium hydroxide, Chlorhexidine, Sodium hypochlorite, Root canal irrigants

Citation for article: Saberi Ea, Farhadmollashahi N, Mousavi E. The effect of different irrigants and intra canal dressing on sinus tract closure. Caspian J Dent Res 2015; 4:13-9.

[Downloaded from cjdr.ir on 2026-11-06]

[DOR: 20.1001.1.22519890.2015.4.2.2.1]

[DOI: 10.22088/cjdr.4.2.13]

تاثیر شوینده‌ها و پانسمانهای مختلف داخل کانال ریشه بر زمان بسته شدن سینوس ترکت

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چکیده

مقدمه: فعالیت ضد میکروبی شوینده ها و پانسمانهای داخل کانال در بین جلسات یکی از ملاحظات مهم در اندودانتیکس محسوب می‌شود. هدف از این مطالعه ارزیابی کارآیی آماده‌سازی کمومکانیکال کانالهای نکروتیک با شوینده‌ها و پانسمانهای مختلف داخل کانال در کنترل عفونت و زمان بسته شدن سینوس ترکت بود.

مواد و روش ها: در این مطالعه ۶۵ بیمار دارای سینوس ترکت تحت درمان قرار گرفتند. بیماران بطور تصادفی به ۴ گروه تقسیم شدند. در گروه ۱ و ۲ از سدیم هیپوکلریت و کلرهگزیدین به ترتیب به عنوان شوینده استفاده شدند و پس از آن کانالها پر شدند. در گروه ۳ پس از شستشو با هیپوکلریت سدیم از کلسیم هیدروکساید / سالین استریل به عنوان داروی داخل کانال و در گروه ۴ پس از شستشو با کلرهگزیدین از کلسیم هیدروکساید / کلرهگزیدین مشابه گروه ۳ استفاده کردیم. پس از ۱ هفته مواد داخل کانال حذف شده و کانالها پر شدند. زمان بسته شدن سینوس ترکت در فواصل زمانی ۷و ۱۴و ۲۱ روز مورد ارزیابی قرارگرفت. داده های بدست آمده با استفاده از آزمون آماری کروسکال والیس و کای اسکوئر آنالیز شدند.

یافته ها: بیشترین میانگین زمان بسته شدن سینوس ترکت مربوط به (کلسیم هیدروکساید/سالین استریل)و کمترین آن مربوط به (کلسیم هیدروکساید/کلرهگزیدین) بود. تفاوت زمان بسته شدن سینوس ترکت بین گروه ۲و۴ ($p= 0.04$)و گروه ۳و ۴ ($p=0.004$) از نظر آماری معنی دار بود.

نتیجه گیری: کلسیم هیدروکساید/ کلرهگزیدین به عنوان داروی داخل کانال، در کنترل عفونت کانال ریشه و بسته شدن سینوس ترکت از کارایی کلینیکی مطلوبی برخوردار بود.

واژگان کلیدی: کلسیم هیدروکساید، کلرهگزیدین، سدیم هیپوکلریت، شوینده های داخل کانال

Introduction

Occasionally, a chronic endodontic infection is drained into or out of the mouth through a connecting path known as sinus tract. In addition to drainage of infectious exudates from sinus tract and relieving the pain, sinus tract helps determining the infection source.[1] Intraoral or extraoral drainage of an abscess depends on the perforation site of the cortical bone by inflammatory process and its relationship to muscle attachments.[2] An intraoral sinus tract usually indicates a necrotic pulp or chronic apical abscess and sometimes periodontal abscess. Vertical root fracture and the root developmental groove are the other cases for differential diagnosis.[1,3] In cases in which the origin of sinus tract is a contaminated root canal system, the sinus tract usually heals spontaneously following endodontic treatment, and no further treatment is necessary. [4]After elimination of the reason of the infection, the sinus tract regularly disappears within 5 to 14 days.[5] In general, there is a belief that the number of remaining bacteries after cleaning and shaping of root canal can be controlled by placing a dressing like calcium hydroxide during treatment sessions.[6] Calcium hydroxide is the most common root canal dressing. This material has unique properties such as tissue solubility, antimicrobial effect and biocompatibility.[7] NaOCl and CHX are other antimicrobial solutions often used as the irrigants and intracanal medicament in endodontic treatments.[7] NaOCl is used as the irrigant of choice because of pulp digestion and its impact on the majority of pathogenic microorganisms.[8] Several in vivo and in vitro studies have evaluated the properties of CHX. [9, 10] In in vitro, antimicrobial effect of CHX was as much or even higher than the calcium hydroxide. [11] Unlike calcium hydroxide, CHX has substantive antimicrobial activity where this property prevents bacterial colonization in root canal detine for long term. [12] Since NaOCL is still the most commonly used irrigant, the antibacterial efficacy of CHX has been compared to that of NaOCL.

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[DOI: 10.22088/cjdr.4.2.13]

The results from these studies are inconclusive, but in general, no significant differences have been reported between the two solutions.[8] Considering the importance of treating sinus tract, the aim of this study was to evaluate the clinical efficacy of chemomechanical preparation of the necrotic canals with different irrigants and intra canal dressing in the control of root canal infection and sinus tract closure.

Materials & Methods

The Ethics Committee in Zahedan Medical University approved the protocol of the study (code: 93-1001). Sixty five systematically healthy patients were selected according to the following criteria. In the clinical evaluation, all teeth were asymptomatic and did not respond to vitality tests and with intraoral sinus tract. In radiographic evaluation, teeth had obvious periapical lesion with no previous endodontic treatment. Exclusion criterias were the presence of developmental groove, crack, periodontal abscess or true combined disease, pregnancy, nursing mothers and any systemic condition that could affect the progression of infectious disease or require antibiotic cover for routine dental therapy. Each patient was given written information about the study protocol and informed consent to participate in the study. All sinus tracts had been traced with gutta percha points and periapical intraoral radiographs were obtained from each tooth. The treatment was performed by one person. The time of Sinus tract closure was evaluated by another person who was unaware of the treatment type.

After anesthesia (2% Lidocaine with epinephrine 1/80,000), the tooth was isolated with rubber dam. The crown and surrounding rubber dam were disinfected. An access cavity was prepared with sterile high speed diamond burs with coolant. Pulp chamber was rinsed by 2.5% sodium hypochlorite (NaOCL) (Home Plus Tehran, Iran) and the working length was estimated and confirmed by radiography. Then, the studied subjects were divided into four groups, using a simple randomization procedure. The groups were matched in terms of tooth type (anterior, premolar, and molar), location (maxilla, mandible), age, and gender.

Group 1: The canal was enlarged using the Crown Down technique with K-file (Dentsply Maillefer, Ballaigues, Switzerland), between each instrument the canal was irrigated by 2.5%NaOCL (Home Plus, Tehran, Iran), EDTA (META BIOMED CO LTD, Cheongwon-gun, South Korea), and 2.5%NaOCL. Sterile saline was used as the final irrigating solution. The canals were dried by paper points and filled with Gutta-percha (SureDent Co, Gyeonggi-do, Korea) and AH_{26} sealer (Dentsply, Konstanz, Germany) using lateral condensation technique. Periapical radiograph was taken at the end and the accuracy of treatment was approved.

Group 2: The canal was enlarged using the Crown Down technique with K-file during instrumentation, the canals were irrigated by using 0.12%CHX (Shahre Daru, Tehran, Iran) sterile saline was used as the final irrigant, and the canals were dried by paper points and filled with Gutta-percha and sealer AH_{26}.

Group 3: Similar to Group 1, the canal was prepared. After drying the canal, it was dressed with a thick mix of Ca $(OH)_2$ (Merck, Darmstadt, Germany) in sterile saline, which was applied to the root canal by means of a spiral paste filler followed by coronal sealing with a zinc oxide eugenol cement. The patients were recalled after 7 days, the intra canal paste was removed and the canal was obturated with Gutta Percha and AH_{26} sealer using the lateral compaction technique.

Group 4: Similar to Group 2, the canal was prepared and dressed with a thick mix of Ca $(OH)_2$/CHX paste followed by coronal sealing. After 7 days, the intra canal paste was removed and obturated with Gutta Percha and AH_{26} sealer using the lateral compaction technique. A final radiograph was taken and the tooth was restored. The patient was followed up within 7, 14, and 21 day intervals after the treatment. It should be noted that the criterion of sinus tract closure is the clinical appearance of normal gingiva at the location of sinus tract, which is not differentiable with the adjacent gingiva. The data were analyzed using Chi Square and Kruskal-Wallis statistical tests.

Results

The distribution of tooth type and location, age, and gender has been homogenized in studied groups, and the results are presented in table 1. According to the Kolmogorov-Smirnov test, the data obtained from the time of sinus tract closure in the studied groups had no normal distribution ($p<0.05$), therefore they were compared using non-parametric tests. There was a significant difference between study groups in the periods up to 7 days, and the forth group had the highest frequency (52.9%) in this period($p <0.05$).

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Table 1. Distribution of tooth type, jaw, location of sinus tract, gender, and mean age in the studied groups

		Group 1	Group 2	Group 3	Group 4	total	P value
Tooth type	Anterior	4	5	5	5	19	0.984*
	Premolar	3	3	3	4	13	0.998*
	Molar	7	9	9	8	33	0.950*
jaw	maxilla	8	11	12	10	41	.857*
	mandible	6	6	5	7	24	.898*
location of sinus tract	Buccal	14	17	16	16	63	0.863*
	Lingual			1	1	2	
Gender	Female	6	7	10	9	32	0.672*
	Male	11	8	5	9	33	0.522*
Age		33.28	35.64	34.29	36.01	34.87	0.861**

Group 1=NaOCl /EDTA, **Group 2**=CHX, **Group 3**=Ca $(OH)_2$/ sterile saline, **Group 4**=Ca$(OH)_2$/ CHX

* Chi-Square test ** One way ANOVA

In the 8-14-day periods, group 4 had significantly lower frequency (41.2%) ($p<0.05$). The frequency of samples without sinus tract closure (17.6%) was also significantly higher than the other groups ($p<0.05$). Table 2 shows the frequency of closing times of sinus tract in 4 intervals. Table 3 shows the mean time of sinus tract closure in the studied groups. The Kruskal-Wallis test shows that there was a significant difference in the duration of the treatment of groups ($p<0.05$). As shown in the Kruskal-Wallis test ranking, the group4 with the lowest rank (10.71±4.37) had significantly less closure time, and the Group3 with the highest rank (13.50±3.32) had the maximum time of closure. Groups1 and 2 were the same in terms of duration of treatment.

Table 2. Comparison of time intervals (days) of sinus tract closure in the studied groups

Sinus tract closure(days)	Group 1 No (%)	Group 2 No (%)	Group 3 No (%)	Group 4 No (%)	P value*
Up to 7 days	4 (28.6)	3 (17.6)	2 (11.8)	9 (52.9)	0.042
8-14 days	8 (57.2)	14 (82.4)	11 (64.7)	7 (41.2)	0.046
15-21 days	1 (7.1)	0 (0)	1 (5.9)	1 (5.9)	
No Reaction to Remedy	1 (7.1)	0 (0)	3 (17.6)	0 (0)	0.031

Group 1=NaOCl /EDTA, **Group 2**=CHX, **Group 3**=Ca$(OH)_2$/ sterile saline, **Group 4**=Ca$(OH)_2$/ CHX

* Chi-Square test

Table 3. Comparison of the mean time (days) of sinus tract closure in the studied groups

Group	Mean ± SD	Mean Rank	P value*
EDTA/NaOCl	12.38±4.19	31.23	0.044
CHX	12.76±2.75	33.38	
Ca$(OH)_2$/sterile saline	13.5±3.32	36.4	
Ca$(OH)_2$/CHX	10.71±4.37	24.41	

* Kruskal-Wallis

Discussion

According to the results of the present research, it can be concluded that mechanical preparation of a canal, the use of different irrigating solutions and intra-canal dressing lead to sinus tract closure within 14 days. In this study, sinus tract of 4 patients of 65 were not closed; these limited number of patients were excluded from the study. In most cases, sinus tract was closed within 14 days. Since the studied groups were matched

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in terms of tooth type (anterior, premolar, and molar), age, and gender, the effect of these variables was eliminated in the treatment outcomes. Many texts have reported the presence of sinus tracts, but no study was performed on sinus tract closure; however, it can be concluded that following reduction of bacteries in the infectious root canal and its adjacent area, the sinus tract would be closed with the mechanical preparation and the use of different irrigating solutions and intra canal dressing. Different studies discussed the effect of anti-bacterial irrigating solutions on reduction of bacteries in an infectious root canal system. Most of these studies concluded that the use of different irrigating solutions causes a significant reduction in number of microorganisms of root canal. For instance, Stewart, in a clinical study, reported negative culture in more than 70 percent of the infectious root canals after chemo-mechanical preparation using anti-bacterial irrigating solutions [13] and the studies carried out by Ercan, Siqueira also showed that chlorhexidine, sodium hypochlorite and EDTA can successfully be used as irrigating solutions. [14,15] However, one study indicated that 7-day medication of canal with calcium hydroxide, 2%CHX gel or a mixture of $Ca(OH)_2$/CHX could not reduce bacterial concentration better than chemo-mechanical preparation of the root canal with 1% NaOCl . [9]

The present study indicates clinical efficacy of Ca $(OH)_2$/ CHX dressing in the control of root canal infection. Canal dressing for 7 days with Ca $(OH)_2$/Sterile saline did not show the expected effect in disinfection the root canal system, indicating the need to develop more efficient inter appointment dressing.

Calcium hydroxide pH is about 12.5 and quickly eliminates most of the root canal bacterial species. [6] However, in parts of the canal space, the hydroxyl ions concentration and the PH value are considerably lower than that. [16] Different species of bacteries have different ability to tolerate pH and often grow well at pH between 6 and 9. Prevotella Intermedia, Fusobacterium Nucleatum and Porphyromonas Gingivalis can survive and grow at PH levels between 8.0 and 8.3. [17]

Several different species of bacteries are located in the tubules of root dentine. [18] It is difficult to predict the effectiveness of a $Ca(OH)_2$ dressing between visits and its ability to destroy the bacterial species located in this areas. It is possible that the present bacteries in the dentinal tubules escape the direct action of calcium hydroxide and are able to reinfect the canal space.[16,19] This may explain why $Ca(OH)_2$ alone was totally ineffective. In the present study, the use of $Ca(OH)_2$/ CHX caused sinus tract closure within 10 days and the use of $Ca(OH)_2$/ sterile saline caused sinus tract closure within 14 days. This can indicate further effect of calcium hydroxide/sterile saline dressing, which is consistent with the study of Bulacio, Mohammadi, Manzur and, Ercan. They concluded that anti-microbial activity of $Ca(OH)_2$/CHX as dressing material increases with time. [20,21,9,22] In addition, Orstavik et al. indicated that calcium hydroxide is unable to remove live bacteries in depth of dentinal tubules due to its low penetration whereas a mixture of calcium hydroxyl/ chlorhexidine disinfects the tubules to the depth of 600 micrometers within a week. [19]

However, the present study is inconsistent with the study carried out by Mohammadi, They found that the activity of anti-microbial is achieved at a PH between 5.5 to 7. Therefore, it seems that alkalinization of PH by adding calcium hydroxide to chlorhexidine precipitates chlorhexidine molecules and reduces its effects. However, it does not change basic properties of calcium hydroxide. [21,23]

In this study, we used $Ca(OH)_2$ for 7 days in canal, which is not similar to the study of Leonardo et al. in which they determined 15 to 30 days for lining a canal. [24]Therefore, with respect to the present research, simultaneous use of $Ca(OH)_2$/CHX for 7 days was effective in sinus tract closure.

Since the clinical, radiographic and histologic success of endodontic treatment of teeth with necrotic pulp and radiolucent periapical areas are strongly influenced by the level of reduction or elimination of intra canal and extra radicular infection, it may be concluded that the adequate biomechanical preparation associated with the application of calcium hydroxide/ Chlorhexidine paste for 7 days represents a good clinical efficacy in the control of root canal infection and sinus tract closure. Finally, it is proposed to examine the effect of the other newer irrigating solutions and intra canal medicaments on sinus tract closure.

Conclusion

It was concluded that the combination of Ca(OH)2/CHX has good clinical efficacy in the control of root canal infection and sinus tract closure.

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Acknowledgments

We thank to Vice Chancellor for Research of Medical Sciences University of Zahedan for approving and financial support of this study.

Conflict of interest: We declare that there is no conflict of interest.

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[DOR: 20.1001.1.22519890.2015.4.2.2.1]
[DOI: 10.22088/cjdr.4.2.13]