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EFFECT OF CHLORHEXIDINE HYDROCHLORIDE ON THE FORMATION OF DENTAL PLAQUE IN MAN. *

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Chlorhexidine hydrochloride가 成人男子의 齒苔形成에 미치는 影響에 關한 硏究

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(指導 李 在 賢 副敎授)

李 容 敏

≫國 文 抄 錄≪

著者는 Chlorhexidine 含漱劑와 口內錠이 成人男子의 齒苔形成에 미치는 影響을 觀察하기 위하여 40名의 서울齒大生을 對象으로 일주일동안 칫솔질을 禁止시키고 다음과 같이 4群으로 나누어 實驗을 行하였다.

實驗 1群 : 10人의 學生에게 하루두번 15ml의 0.2% chlorhexidine 溶液으로 1分間 含漱시킴.

實驗 2群 : 10人의 學生으로 構成된 對照群, 이들에겐 15ml의 placebo 溶液으로 하루두번 1分間 含漱시킴.

實驗 3群 : 10人의 學生에게 10mg의 chlorhexidine 口內錠을 하루세번 5分동안 口腔內에서 녹이게함.

實驗 4群 : 10人의 學生으로 構成된 對照群, 이들에겐 placebo 口內錠으로 하루세번 5分間 口腔內에서 녹이게함.

以上 4群의 7日間의 平均 齒苔指數成績을 서로 比較觀察한 結果 다음과 같은 結論을 얻었다.

1. 0.2% chlorhexidine hydrochloride로 含漱시킨群은 對照群에 比해 80% 程度의 齒苔形成抑制效果를 나타냈다.
2. chlorhexidine 口內錠을 투여한 群도 對照群에 比해 約56% 程度의 齒苔形成抑制效果를 나타냈으나 이는 含漱溶液과 比較해 볼때에는 그 效果가 相當히 떨어지는 것이었다.

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INTRODUCTION

It is now well recognized that dental plaque is a major factor in the initiation and development of gingival disease.[20]

New knowledge on the development, structure and chemistry of dental plaque suggests that they consist mainly of bacteria and bacterial products.[6][12][18][19]

Accordingly, prevention and inhibition of dental plaque may possibly be achieved by either controlling the oral flora to a degree where colonization on the teeth does not occur or by direct antibacterial action on the tooth surfaces.

There has been a constant search for agents which would inhibit dental plaque formation.[1][3][4][5][8][9][10][14][15][21][22][23]

Among many anti-plaque agents, chlorhexidine was chosen as the active agent of the mouthwash because of its broad effect on bacteria and yeasts, its low toxicity and wide-spread use in clinical medicine.

Furthermore, this chemical compound was reported to have a marked affinity for tooth enamel and significantly reduce bacterial colonization on tooth surfaces.

In addition, chlorhexidine gluconate was found very effective in reducing early calculus formation on Mylar strips.[1]

Löe (1970) reported that a mouthrinse containing 0.2 per cent Chlorhexidine gluconate effectively prevented plaque formation and that a topical application of a 2 per cent sloution inhibited the formation of dental plaque completely.[13]

The purpose of present investigation was to determine the effect of chlorhexidine hydrochloride rinsing solution and its lozenge on the formation of dental plaque in man.

MATERIAL AND METHOD

40 male dental students with clean teeth and healthy gingiva, 23 to 27 years of age, were selected in this study.

Prior to each experimental period all subjects had their teeth scaled and polished. They were then examined until dental plaque index scores approached zero.

All active oral hygiene procedures were stopped and the students randomly assigned to one of the following groups.

Mouth rinsing group:

group 1……10 students rinsed with 15ml of a 0.2 per cent aqueous solution of chlorhexidine hydrochloride * (pH : 6.5) for one minute twice a day (at 10 a.m. and 10 p.m.) for 7 days.

group 2……10 students rinsed with 15ml of a placebo solution (pH : 6.8) for one minute twice a day (at 10 a.m. and 10 p.m.) for 7 days.

The rinsing solution was dispensed daily in plastic capped bottle containing 30ml of liquid.

*Imperial Chemical Industries, Macclesfield, U.K.

Mouth lozenge group:

group 3……consisted of 10 students treated with 10mg chlorhexidine hydrochloride mouth lozenges for 5 minutes 3 times a day for 7 days.

group 4……consisted of 10 students treated with placebo mouth lozenges for 5 minutes 3 times a day for 7 days.

During the experimental period all subjects were refrained from brushing their teeth.

On the day of 1, 3, 5, and 7 all subjects were evaluated for the amount of dental plaque that had accumulated on their teeth and intra-oral photographs were taken to observe clinical changes.

To visualize the accumulated dental plaque, both bucco-labial and lingual surfaces of the entire natural dentition except the third molars were painted with a Malachite green disclosing solution.

The amount and extent of plaque accumulation were estimated by using a modification of the method of Quigley and Hein.[16]

Plaque scoring criteria were defined as follows:

0……no stained plaque on the tooth surface.

1……approximately one sixth of the surface covered with stained plaque.

2……approximately one quarter of the surface covered with stained plaque.

3……approximately one third of the surface covered with stained plague.

4……more than one third of the surface covered with stained plaque.

In all groups the plaque indices were recorded by one examiner.

The effect of chlorhexidine hydrochloride in both rinsing solution and mouth lozenge could be ascertained by statistically comparing the mean plaque score of the placebo group and experimental group.

RESULTS

Mouth rinsing.

Two daily rinses of 0.2 per cent chlorhexidine hydrochloride resulted in inhibition of dental plaque effectively and no gingival changes occurred.

As shown in table Ⅰ, on the third day there was a 72 per cent reduction in the

Table Ⅰ. Per cent reduction of dental plaque scores after 1-, 3-, 5-, and 7 day use of a mouth rinse containing 0.2% chlorhexidine hydrochloride.

Day after treatment	Control group	Experimental group	Percent reduction	P value
1st	20.1±5.8	6±3.7	70.2	<0.001
3rd	110.4±24.4	36.4±10.2	72.3	<0.001
5th	170.2±12.2	34.1±10.9	80.0	<0.001
7th	193.9±8.1	34.2±13.6	82.4	<0.001

* Each value presents mean plaque scores ± S.D.

* Number of subjects in each group is 10.

formation of dental plaque in the experimental group compared with the placebo group.

On the 7th day, there was more than 80% decrease of dental plaque scores in chlorhexidine rinsing group compared with the placebo group.

On the 5th day, a yellow-brown stain was initially observed on the dorsum of the tongue in some students of chlorhexidine rinsing group. On day 7 some discoloration of the teeth occurred in a few students of experimental group.

The subjects of the control group did not exhibit any stain or discoloration.

Mouth lozenge.

The daily administration of 30mg chlorhexidine hydrochloride mouth lozenges also inhibited the formation of dental plaque. As noted in table Ⅱ, there was a 74 per cent reduction of plaque scores in chlorhexidine lozenge group compared with placebo group on day 3.

On day 7 there was only 56 per cent reduction in plaque formation in the experimental group compared with the control group.

Table Ⅱ. Per cent reduction of dental plaque scores after 1-, 3-, 5-, and 7 day use of a chlorhexidine hydrochloride mouth lozenges (30mg/day).

Day after treatment	control group	experimental group	percent Reduction	P value
1st	26.1±12.2	3.0±1.8	88.4	<0.001
3rd	111.6±9.7	28.8±16.1	74.1	<0.001
5th	162.8±15.0	71.1±10.4	56.3	<0.001
7th	191.5±12.2	82.6±8.3	56.8	<0.001

* Each value presents mean plaque scores ± S.D.
* Number of Subjects in each group is 10.

On the 6th day a few students of chlorhexidine lozenge group exhibited some yellowish stain on their tongue.

No other specific changes in teeth, gingiva and oral mucosa were observed in all subjects.

DISCUSSION

Published reports have indicated that chlorhexidine is highly efficacious in preventing dental plaque formation [1)2)3)7)11)12)13)].

Löe and Rindom Schiott reported that two daily mouthrinses with 0.2 per cent chlorhexidine gluconate inhibited the plaque formation almost completely. [11)13)]

Cangro and Picozzi also reported that a mouthrinse containing 0.1 per cent chlorhexidine gluconate showed a highly significant reduction in early calculus deposits. [1)]

Turesky et al. [22)] found that only adhesive antibacterial chemical such as chlorhexidine formed antimicrobial films which inhibited plaque formation.

In the present study, the effect of a 0.2 per cent chlorhexidine hydrochloride rinsing solution showed a highly significant reduction in plaque formation.

Especially, on the 7th day after two daily rinses with chlorhexidine hydrochloride the per cent reduction of plaque scores was more than 80 per cent.

Löe et al. reported that all tooth surfaces became plaque-free on the 6th day after 2 daily rinses with 0.2 per cent chlorhexidine gluconate.[11)12)13)]

This higher effect of chlorhexidine gluconate compared with its hydrochloride, may be explained by the difference in solubility.

Chlorhexidine forms salts of relatively low solubility in water with chloride [17)].

In chlorhexidine rinsing group, the per cent reduction of dental plaque on day 5 and day 7 was markedly higher than that of day I and day 3.

This increased inhibitory effect on day 7 indicates that even already formed plaque deposits can be removed by the repeated mouthrinses.[18)]

Löe found that chlorhexidine adsorbed to hydroxyapatite and tooth surfaces.[17)]

He suggested that chlorhexidine might be adsorbed to the dental plaque and pellicle surfaces during a mouthrinse, and that chlorhexidine reservoirs were formed at these locations, producing a long lasting effect.

The adsorbed chlorhexidine is released from tooth surfaces when the concentration of this substance in the environment decreases.

On the other hand, the results with chlorhexidine hydrochloride mouth lozenge was not so significant in reducing dental plaque formation compared with rinsing solution, although there was a high percent reduction in early plaque formation (on day 1 and day 3).

This earlier marked reduction in chlorhexidine lozenge group may be related to the frictional effect which was resulted in melting the mouth lozenges in the oral cavity.

In mouth lozenge group, it seemed to be very difficult to make the chlorhexidine reach all tooth surfaces.

In the present study, the higher inhibitory effect of chlorhexidine rinsing solution compared with its lozenge could be due to the difference in concentration used in this experiment, or that more chlorhexidine is incorporated into the enamel or plaque during mouth rinsing.

SUMMARY

An experimental study was done in 40 male dental students to investigate the effect of chlorhexidine hydrochloride rinsing solution and its lozenge on the formation of dental plaque in man.

The results obtained are summarized as follows:

1) A mouth rinse containing 0.2% chlorhexidine hydrochloride was highly effective in inhibiting dental plaque formation.
2) The effect of a chlorhexidine mouth lozenge also showed a significant reduction in early dental plaque formation.

3) 0.2% chlorhexidine hydrochloride rinsing solution appeared to be more effective in inhibiting dental plaque formation than its lozenge.

=ACKNOWLEDGEMENT=

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REFERENCES

1) Cangro, L.P., Paulovich, D.B., Klein, K., and Picozzi, A., Effects of a chlorhexidine gluconate mouth rinse on dental plaque and calculus. J. periodont., 43 : 687, 1972.
2) Cumming, B.R., and Löe, H., Optimal dosage and method of delivering chlorhexidine solutions for the inhibition of dental plaque. J. Periodont. Res., 8 : 57-62, 1973.
3) Davies, R.M., Jensen, B., Schiött, C. R., and Löe, H., The effect of topical application of chlorhexidine on the bacterial colonization of the teeth and gingiva. J. periodont. Res., 5 : 96, 1970.
4) Dolan, M.M., Kavanagh, B.J., Yankell, S. L., Artificial plaque prevention with organic fluorides. J. periodont., 43 : 561-563, 1972.
5) Fischman, S.L., Picozzi, A., Cangro, L.P., and Pader, M., The inhibition of plaque in humans by two experimental oral rinses. J. of periodont. 44 : 100-102, 1973.
6) Gibbons, R.J., and Houte, J.V., On the formation of dental plaque. J. of periodont. 44 : 347-360, 1973.
7) Hamp, S.E., Lindhe, J., and Löe, H., Long term effect of chlorhexidine on developing gingivitis in the Beagle dog. J. Periodont. Res., 8 : 63-70, 1973.
8) Kaslick, R. S., Tuckman, M.A., and Chasens, A.I., Effect of topical vancomycin on plaque and chronic gingival inflammation. J. Periodont., 44 : 366-368, 1973.
9) Lobene, R.R., Brion, M., and Socransky, S. S., Effect of erythromycin on plaque and plaque formation migcroorganisms of man. J. periodont. 40 : 287, 1969.
10) Lobene, R.R., A clinical study of the effect of dextranase on human dental plaque. J.A.D.A., 82 : 132, 1971.
11) Löe, H., and Schiött, C.R., The effect of mouthrinses and topical application of chlorhexidine on the development of dental plaque and gingivitis in man. J. periodont. Res., 5 : 79, 1970.
12) Löe, H., and C. Rindom Schiött, The effect of suppression of the oral microflora upon the development of dental plaque and gingivitis. Dental Plaque, Ed. W.D. McHugh, E. & S. Livingstone, Edinburgh, 1970.
13) Löe, H., and C.R., Schiött, The effect of mouthrinses and topical application of chlorhexidine on the development of dental plaque and gingivitis in man. J. Periodont. Res., 5 : 79-83, 1970.
14) McFall, W.T., Shoulars, H.W., and Carnevale, R.A., Effect of vancomycin in the inhibition of bacterial plaque formation, J. Dental Res., 47 : 1256, 1968.
15) Mitchell, D.F., and Holems, L.A., Topical antibiotic control of dentogingival plaque. J. Periodont., 36 : 202-208, 1965.
16) Quigley, G., and Hein, J., Comparative cleansing efficiency of manual and power brushing. J. Amer. Dent. Assoc., 65 : 26-29, 1962.
17) Rölla, G., Löe, H., and Schiött, C.R., The affinity of chlorhexidine for hydroxyapatite and salivary mucins, J. Periodont. Res., 5 : 90, 1970.
18) Schiött, C.R., Löe, H., Jensen, B., Kilian,

M., Davies, R.M., and Glavind, K., The effect of chlorhexidine mouthrinses on the human oral flora. J. periodont. Res., 5 : 84, 1970.
19) Schroeder, H.E., Formation and inhibition of dental calculus. Hans Huber, Berne, Switzerland, 1969.
20) Shafer, W.G., Hine, M.K., and Levy, B. M., A Textbook of oral pathology Chap 7. philadelphia, W.B. Saunders Co., 1963.
21) Shipman, B., Cohen, E., and Kaslick, R., The effect of a urea peroxide gel on plaque deposits and gingival status. J. periodont., 42 : 283-285, 1971.
22) Turesky, S., Glickman, I., and Sandberg, R., In vitro chemical inhibition of plaque formation. J. periodont., 43 : 263-269, 1972.
23) Volpe, A.R., Kupczak, L.J., J.H. Brant, W.J. King, R.C. Kestenbaum, and H.J. Schlissel, Antimicrobial control of bacterial plaque and calculus and the effects of these agents on oral flora. J. Dent. Res. Supplement to No. 5, Vol. 48 : 832, 1969.

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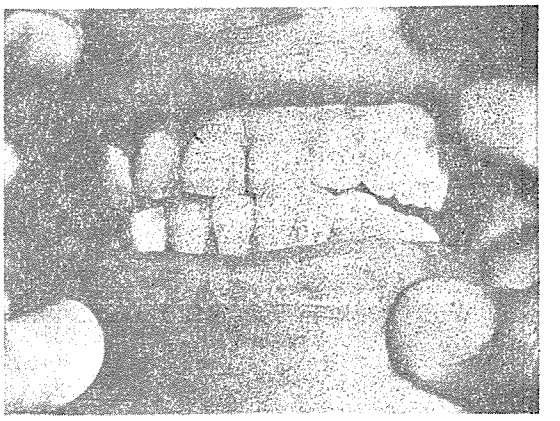
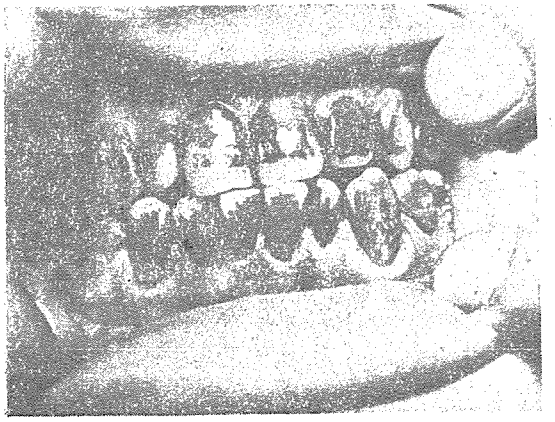
=EXPLANATION OF FIGURES=

<Fig. 1>

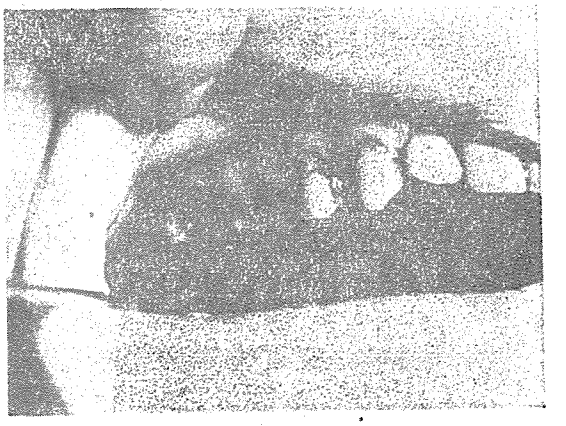


<Fig. 2>

Fig. 1 and Fig. 2 : Clinical photograph of teeth in placebo rinsing (Fig. 1) and chlorhexidine rinsing subject (Fig. 2) on day 7.



<Fig. 3>



<Fig. 4>

Fig. 3 and Fig. 4 : Clinical photograph of teeth in placebo lozenge subject (Fig. 3) and chlorhexidine lozenge subject (Fig. 4) on day 7.