



RESEARCH ARTICLE

The Effect of Chewing Gum on Oral Mucositis in Children Receiving Chemotherapy

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Abstract

Background: Oral mucositis is an important clinical problem, resulting in significant patient morbidity, a change in health-related quality of life, and supportive care. The purpose of this study was to assess the efficiency of chewing gum on children, who are receiving chemotherapy regimens, for prevention and treatment of oral mucositis.

Method and Material: The study sample consisted of 60 children (30 study group-30 control group) between the ages 6-18 years. All the children have received chemotherapy at least once. Study group children chewed non-sugar gums three times a day at least 20 minutes during 10 days. In oral assessment, WHO Oral Mucositis Assessment Scale and Eilers' Oral assessment Guide was used and also salivary pH measurement was done.

Results: The rate of children who was assessed as Grade 1 and Grade 2, decreased 46.1% in study group and this rate decreased to 20.8% in the control group. At the beginning of the study, 13.3% of the study group children were assessed as Grade 3 but at the end of the study none of the children were observed at Grade 3. Also, statistically significant difference was found between study and control groups' pH values.

Conclusion: The results of that study show new

evidence about preventing and decreasing severity of oral mucositis for the children, receiving chemotherapy.

Keywords: Children, chewing gum, nurse, oral mucositis

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Introduction

One of the most common side effects of cancer treatment was mucositis, a painful inflammation and ulceration of the mucous membrane. Oral mucositis is a consequence of the toxic effects of chemotherapeutic agents and irradiation on oral mucosa cells.^{1,2} The incidence and severity of mucositis depend on the patient features and the kind of cancer treatment. The frequency of oral mucositis has been reported to be around 65% in pediatric cancer patients.³ Numerous studies have also indicated that children have a higher risk of developing oral mucositis than adults. Comparing to adults, children's oral mucositis level's being higher is related with their treatment protocols that is more intensive and that includes higher doses.^{3,4,5}

Although oral mucositis is not a fatal complication, it is nonetheless, very distressing for patients. It is a condition that directly affects the patient's quality of life due to its multiple clinical signs and symptoms.^{6,7} Oral complications are responsible for oral discomfort, burning sensation, pain, and nutritional difficulties for patients. These oral symptoms may have a profound impact on the most fundamental activities of daily life, such as speaking, chewing, swallowing food and taking fluids, and breathing. For some patients, it becomes impossible to eat or drink anything or even to swallow their own saliva spontaneously.^{2,8,9} At the same time, these effects can reduce the capability of tolerating to the

planned treatment and might cause skipping of dose or reducing of doses.⁷ While the mortality rate was 1% for patients with mild severity mucositis, it was found out as 40% for severe ulcerations. These data emphasise the importance of mucositis, and effects of morbidity and mortality on the patients with cancer.¹⁰ Prevention and management of oral complications are important not only for improving the quality of life of the patients but also for successful cancer treatment outcomes.^{6,9,11}

In Cochrane data base, 29 different kinds of interventions were examined in the 71 randomized controlled studies, which are done in order to prevent and reduce the severity of oral mucositis for the patients with cancer.^{11,12} Amifostine, klorhexidin, ice therapy, pastilles with antibiotic, and mouth care protocols are among these effective interventions. Even though there are lots of different outcomes in different studies, no effective treatment strategies have come out yet in order to prevent and treat mucositis.^{3,11,13} Although there are many researches for prevention of mucositis and for its treatment, they are so limited in pediatric population.

Chewing gum, as a non-pharmalogical intervention, has been testing on patients with cancer since 1990's in order to prevent oral complications and for their treatment as well.² The main reason, why intraoral complications occurs in the patients, who are receiving chemotherapy, is that their salivation decreases and their pH level falls radically. It is aimed that these patients's salivation and pH levels be increased by making them chew gums.⁷ By the studies on that issue, it is showed that by chewing the salivary flow increase 3- fold to 10 fold and pH level rises significantly.^{3,8,14} These results are fairly important for preventing oral mucositis, which is the complication of chemotherapy, and for its treatment as well. Even though there has been some studies on that issue, more evidence

are needed to standardize the interventions at clinics.¹¹ The purpose of this study was to assess the effect of chewing gums on preventing oral mucositis and decreasing its severity.

Methodology

Study Design and Setting

This study design was quasi-experimental with a control group. The study was carried out in a university hospital's pediatric oncology clinic in Istanbul, between August 2011 and February 2012. Sixty children were participated in the study between the ages 6-18 years who had received chemotherapy for hematological malignancies or solid tumours. There were 30 children both in the control and in the study groups. Study and control groups' children had similar baseline characteristics.

These characteristics are:

- All the children have began the chemotherapy treatment and they have received chemotherapy at least once and their treatment has still continued.
- They were hospitalized children and they will receive chemotherapy at least 4 times.
- In the assessment done at the beginning of the study, none of the children at both groups have a recurrent herpes simplex virus mucositis story and none of them got oropharyngeal radiation therapy.
- Oral mucositis severity of the children at both groups varies between grade 1-3. (At the time when the study was conducted, there was not any children who were assessed as Grade 4).

Procedure

After necessary permission had been taken from the institution where the study had taken place, written informed consent was obtained from the parents of each child. In the first interview with



child and his/her parent, an information form was filled that identified the demographic characteristics of child and family. Children who were in the study group were chewed non-sugary gums for 10 days and 3 times per day. The recommended chewing time was 20 minutes. Children were instructed to abstain from drinking and eating one hour before chewing gum. During this period the subjects in both of our study groups used tantum mouthwash as a part of standard oral care and were asked to continue their usual tooth brushing. At the beginning of the study, on 5th and 10th days children's intraoral assessments were done according to WHO Oral Mucositis Assessment Scale and Eilers' Oral Assessment Guide and pH measurements were taken. Oral assessment and pH measurement was done by researchers. In order to remove the individual measurement differences, all of assessments for each child was done by the same researcher.

Measures

In this study, two different forms were used in order to assess mucositis occurrence and severity. First form was developed by WHO.¹⁵ The WHO Oral Mucositis Assessment Scale was chosen because it is the most commonly used scale and its objective scoring system is accepted scientifically also use of it is fairly easy. Since WHO's scale was not so detailed, Eilers' Oral Assessment Guide (OAG) was used as a second form. That form assesses oral functional and anatomical characteristics more detailed when compared to that of WHO's. The oral assessment guide was developed by Eilers et al.¹⁶ consists of eight categories—voice, swallow, lips and corner of mouth, tongue, saliva, mucous membranes, gingiva, and tooth. The scale, which was prepared according to Likert system and it ranged from 1 (normal) to 3 (definitely compromised). The scale's total score ranges between 8-24. There is no breaking point in the scale; the higher score shows the increasing severity of mucositis.¹⁶

One of the most important effects of chemotherapy treatment is that it creates a change in salivary pH value from alkali towards acid. The decrease in salivary pH value is one of the most important factor for the occurrence of mucositis. In order to assess the effect of chewing on salivary pH value the other assessment criteria which was taken into consideration in that study was intraoral pH measurement. The pH was measured within 1 minutes after chewing by researchers. The pH value were measured by using pH colormatic strips. During pH measurement test stripes were placed under the tongue and kept there for 2 minutes. Then, change in the color of stripes were compared with reference color scale and pH value was determined. In these stripes, pH value varies between 4.0-9.0.

Statistical Analysis

The results were analyzed statistically using the SAS statistical program (version 9.3, 99PVKY, Istanbul, Turkey). Characteristics of the sample were described using mean and standard deviation, frequencies, and percentages. Differences between groups were examined using the Mann-Whitney U test. The threshold for statistical significance was set as $p < .05$.

Ethical procedures

After detailed analysis of aim, sample, data collection tools and interventions of the study, the necessary permission was obtained from National Ministry of Health. After that; the permission for undertaking this study was obtained from the Hospital's Ethics Committee. Children and their mothers were informed about the purpose of the study. After receiving verbal consent from both the child and parent, the parent signed a written informing consent form. Participation to the study was voluntarily and the results were recorded confidentially.



Results

Between August 2011-February 2012, the total of 60 children were included in the study; 29 boys and 31 girls. The mean age of children was 10.2 ± 2.6 (Range = 6-18). Analysis of the demographic data revealed no statistically significant differences between the control and study groups in relation to age, gender and educational states. The most common diagnosis was acute lymphoblastic leukaemia (ALL) (30%). Table 1 describes the clinical characteristics of the 60 patients.

At the beginning of the study, there was no statistically significant difference in the severity of mucositis between two groups. But, at the end of the study, significant difference was found in the mucositis severity of two groups. The mucositis severity and comparison of two groups according to WHO's scale is shown in Table 2.

In the oral assessment conducted according to Eilers' Oral Assessment Guide, study group's score was found as 14.3 ± 2.5 (Range = 9-19) and it was 15.4 ± 3.2 (Range = 8-20) in the control group. In the first oral assessment it was not found statistically significant differences between the two groups. The assessment done in the middle of the study that is the 5th day, study group's score was found as 12.4 ± 3.8 (Range = 8-18) and it was 14.3 ± 4.0 (Range = 8-20) in the control group. In the assessment done at the end of the study, study group's score was found as 10.8 ± 3.8 (Range = 8-20), and control group's score was found as 14.1 ± 4.2 (Range = 8-20) and that results were statistically significant ($p < .05$).

At the beginning of the study, study group's intra-oral pH value was found as 5.8 ± 0.6 and that of control group's 5.9 ± 0.3 . At the end of the study that is the 10th day, pH values are measured as 6.4 ± 0.2 in study group and as 6.0 ± 0.3 in control group. This result was found statistically significant ($p < .05$). The comparison of the pH values between two groups was shown in

Figure 1.

Discussion

In recent years, the trend of using non-chemical methods for mouth care increased.^{2,8} Chewing gum starts to be the subject of studies and becomes one of the most important methods of non-chemicals.^{17,18,19} In this study, the children, who receiving chemotherapy, are chewed non-sugary gums, 3 times a day and for 20 minutes, and a statistically significant difference was found before and after they chewed gums. The rate of children whose mucositis severity was Grade 1, fell from 63.3% to 40.0% after they chewed gum. In the study done by Gandemer et al.¹⁷, when the oral mucositis severity of groups are compared, in spite of differences between these two groups, it was found that the result was not statistically significant. In the study which assess the effect of gum on mouth flora by Söderling et al.,²⁰ it is pointed out that mucositis severity decreases in the patient group who chews gum but that result is not significant for control group. The results of our study are fairly important since it is significant.

During the chemotherapy, it is an important problem that the amount of saliva decreases, saliva intensity increases and pH value falls. Chewing gum is a convenient way to increase salivary flow and stimulate the activity of the salivary glands. Chewing gum increases salivary flow through a combination of gustatory and mechanical stimulation.^{21,22} According to the results of the study, before chewing gums, there was no statistically significant difference in salivary pH values between the study and control groups but after chewing gums, pH values of the study group were significantly higher than that of control group ($p < .05$). Polland et al.,²² found out in their study that the sample group who chews gum for 90 minutes creates a significant difference; also, that difference is the highest at 30th minutes.¹³ In their study which focuses on the effects of gum on intraoral infections, Ribelles



et al.,¹⁹ determined that the group who chews gums creates a significant difference in their pH values. In the study by Fraga et al.,²³ gum's effects of streptococcal based on intraoral infections, it was found out that intraoral pH values of the group who chews gum increase dramatically.

The results of this study come up with new evidence on preventing and decreasing severity of the oral mucositis for the pediatric group who receiving chemotherapy treatment. Although lots of studies points the effects of chewing gums on preventing of mucositis and decreasing its severity for pediatric group, they are come up with no statistically significant results.^{6,14} In this study, significant results are occurred in the mucositis severity level for the group who chews gum. According to results, 46.1% falling is found in the mucositis severity of Grade 1 and Grade 2 groups.

Conclusion

No method and treatment are accepted for the treatment of oral mucositis. Moreover, a lot of intervention and treatment are recommended for the decreasing of mucositis severity and its preventing. According to the results of this study, chewing gum is an effective intervention of preventing and treating oral mucositis. When its easiness in practice together with financial status are taken into consideration, it can be recommended that chewing gum should take place in nursing care for the children with cancer.

Limitations

There were several limitations in this study. The feasibility of generalizing our findings is limited because only selected patients in a pediatric oncology clinic were included in the sample. Even though the results of this study put important proofs for the mucositis treatment related with cancer treatment, the biggest limitation was that not all the children, included in the study, had the same mucositis severity. In order to get more clear results in the mucositis treatment, children

with the same level of mucositis (ie only grade 3 and 4) had to be compared. Significant results of this study will be a base for the future studies.

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ANNEX

Table 1. Clinical characteristics of the sample

Characteristics	Study group	Control Group	Total
Diagnosis			
AML	26.7	23.3	23.3
ALL	26.7	30.0	30.0
Hodgkin's Lymphoma	26.7	21.7	21.7
Wilms' tumor	20.0	25.0	25.0
The duration of hospitalization/day (mean±SD)	45.3±26 .0	44.0±26.1	44.0±26.1
Number of receiving chemotherapy (mean±SD)	3.93±1.92	4.26±1.94	4.1±1.92
Duration of disease/year (mean±SD)	5.1±3.6	5.1±3.7	5.1±3.7

Table 2. Incidence of oral mucositis according to WHO's scale

Oral Mucositis Grade	Study group	Control group	p
<i>First assessment</i>			
Grade 0	-	3.3	.75
Grade 1	63.3	56.7	
Grade 2	23.3	40.0	
Grade 3	13.3	-	
<i>Final assessment</i>			
Grade 0	53.3	30.0	.02*
Grade 1	40.0	43.3	
Grade 2	6.7	33.3	
Grade 3	-	-	

* $p < .05$ statistically significant

Table 3. Comparison the functionality of the mounth between two groups

Functional signs	Study group	Control group	p
Voice			
<i>First assessment</i>			
Normal	40.0	26.7	.27
Raspy	60.0	73.3	
<i>Final assessment</i>			
Normal	96.7	50.0	.02*
Raspy	3.3	50.0	
Swallowing			
<i>First assessment</i>			
Normal	20.0	20.0	1.00
Painful	80.0	80.0	
<i>Final assessment</i>			
Normal	83.3	46.7	.01*
Painful	16.7	53.3	
Lips			
<i>First assessment</i>			
Normal	1.7	3.3	.94
Dry	63.3	65.0	
Cracked	23.3	26.7	
Ulcerated	10.0	5.0	
<i>Final assessment</i>			
Normal	63.3	33.3	.03*
Dry	13.3	46.7	
Cracked	23.3	20.0	
Ulserated	-	-	
Ability to pull out the tonque			
<i>First assessment</i>			
Easy	26.7	50.0	.06
Difficult	73.3	50.0	
<i>Final assessment</i>			
Easy	83.3	73.3	.35
Difficult	16.7	26.7	

**Table 3 continous****Saliva***First assessment*

Normal	3.3	-	.69
Watery	60.0	63.3	
Thick	36.7	33.3	
Absent	-	3.3	

Final assessment

Normal	46.7	-	.01*
Watery	40.0	26.7	
Thick	13.3	53.3	
Absent	-	20.0	

Ability to open the mounth*First assessment*

Easy	26.7	50.0	.06
Difficult	73.3	50.0	

Final assessment

Easy	96.7	76.7	.02*
Difficult	3.3	23.3	

Ulceration*First assessment*

Normal	20.0	14.8	.34
1-2 ulcers	53.3	60.0	
≥3 ulcers	20.0	18.2	
Confluent ulcers	6.7	7.0	

Final assessment

Normal	70.0	-	.01*
1-2 ulcers	10.0	33.6	
≥3 ulcers	20.0	43.0	
Confluent ulcers	-	23.3	

* *The mouth functionality was assessed according to "Eilers' Oral Assessment Guide (OAG)"*

* *p < .05 statistically significant*

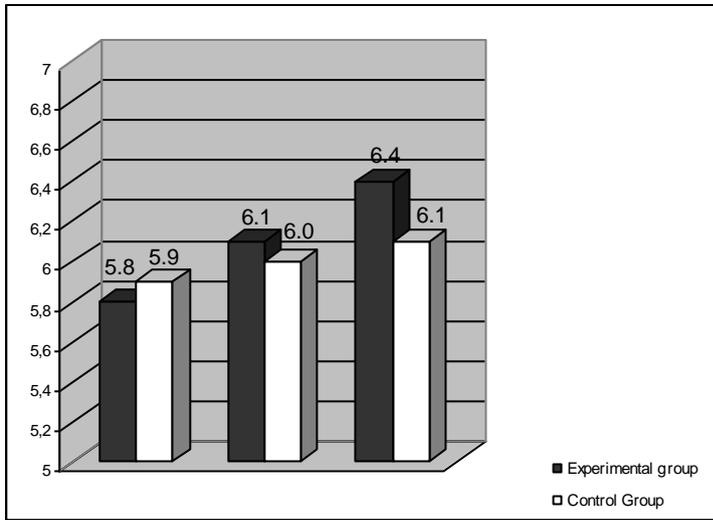


Figure 1. Comparison of pH values between the two groups

First assessment $p=.08$; mid-term assessment $p= .06$; final assessment $p=.03$