IJNH

Research Article

Effectiveness of Oral Ice Cube Application on Prevention of Oral Mucositis among Cancer Patients Who Receive Chemotherapy

R. Regi Bai

Department of Medical Surgical Nursing, RVS College of Nursing, Coimbatore, Tamil Nadu, India

Abstract

Background: Mucostitis has been shown to occur in patients receiving chemotherapy. Oral ice cube application is an alternative method of preventing stomatitis associated with chemotherapeutic drugs.

Aim: The aim of the study was to assess the level of oral mucositis (OM) among cancer patients who receive chemotherapy before and after the application of oral ice cubes.

Research Methodology: The research design selected for the study was pre-experimental one group pre-test post-test research design. Thirty in-patients who receive chemotherapy (5-fluorouracil and methotrexate) were taken as the samples in convenience sampling method. Ice cubes were applied on the oral mucosa before infusing chemotherapy session for 5 min and 20 min after session. Oral assessment guide (OAG) was used prior and on 7th-day post-intravenous chemotherapy to assess the level of OM.

Results: In pre-test, 100% of the cancer patients were with healthy oral mucosa. In the post-test, 73.3% of cancer patients were with healthy oral mucosa and 26.5% were with moderate OM. The paired "*t*" test value was 3.3 for healthy mucosa and 2.17 for moderate mucositis. There was no evidence of severe mucositis. All the "*t*" values are high when compared to table value 2.05. It seems that there is significant effectiveness of oral ice cubes on prevention of OM among cancer patients who receive chemotherapy. The overall mean percentage score for pre-test was 100% whereas in post-test it was 73.25% revealing a difference of 26.75%. It depicts that the oral ice cube application on the prevention of OM was effective among cancer patients who receive chemotherapy. Chi-square reveals that there was a significant association ($P > 0.05$) found between the post-test scores OAG and demographic variables like frequency of check-ups.

Conclusion: Results revealed that there is significant in the mean total scores of the group and who received oral ice cubes had healthy oral mucosa. It was concluded that oral ice cubes reduce the level of OM induced by chemotherapy. Oral ice cube application can be included in the nursing care of cancer patients who receive Chemotherapy.

Keywords: Cancer patients, chemotherapy, oral ice cube application, oral mucositis

Introduction

Cancer is one of the second largest killer diseases next to heart disease. The worldwide incidence of cancer is estimated at seven million, with an annual mortality of about five million. The three leading causes of death due to cancer are cancer of lung 17.8%, stomach 10.4%, and liver 8.8%. Management of cancer consists of surgery, radiation, and chemotherapy. Among these chemotherapy is the most common treatment modality, which controls the uncontrolled cell division by interfering with cellular function and reproduction. Chemotherapy may be used to reduce tumor size preoperatively, to destroy any remaining tumor cells postoperatively, or to treat some forms of leukemia. Cells with rapid growth rates such as bone marrow, epithelium, hair follicles, and sperm are very susceptible to damage due to chemotherapy. The rapid rate of proliferation of epithelial lining of oral cavity makes it susceptible to the effect of chemotherapy resulting in oral mucositis (OM). The exact

Access this article online
Website: http://innovationalpublishers.com/Journal/ijnh
ISSN No: 2454-4906
DOI: https://doi.org/10.31690/ijnh/39

Address for Correspondence:
R. Regi Bai, Department of Medical Surgical Nursing, RVS College of Nursing, Coimbatore, Tamil Nadu, India. Phone: +91-8870534383.
E-mail: godwin_4u@rediffmail.com

pathophysiology of mucositis is not fully elucidated, but it is thought to have two mechanisms: Direct mucositis and indirect mucositis, caused by chemotherapy and or radiation therapy.

Stomatitis is an inflammation of the oral mucosa which may include the cheek, lips, tongue, palate, and floor of the mouth. It can occur in any region of the mouth but more frequently affects non-keratinized regions such as the buccal mucosa, soft palate, and the floor of the mouth.[1] Stomatitis begins on the 3rd–5th days from starting chemotherapy with a peak on the 7th–14th days after chemotherapy and normally past for 3 weeks.[2] Stomatitis is caused by the direct effect of chemotherapy by interfering with actual cell production, maturation, and replacement and indirectly due to bone marrow depression during which neutropenia and thrombocytopenia lead to increased risk of bleeding and infection.[3] Alterations of normal oral health influence quality of life through changes that affect these activities.[4] Oral stomatitis is a common complication of cancer therapy. Stomatitis results from damage to the mucosal epithelium after delivery of chemotherapy or radiation designed to treat cancer.[5] Under normal conditions, oral mucosa, and normal saliva activity are two important barriers that prevent invasion by microorganisms. Nevertheless, in the presence of chemotherapeutic drugs this barrier becomes disrupted. Stomatitis disrupts the function and integrity of the oral cavity, which affects functional status and quality of life.[6,7] Stomatitis is linked to clinical morbidity, pain, malnutrition, and local and systemic infections.[8] Treatment delays and dosage adjustments can also occur resulting in dose reductions in subsequent cycles of chemotherapy or even discontinuation of treatment. Dose reductions have been seen in 60% of patients and discontinuation of regimens in about 30%.[9]

Oral cryotherapy is the application of ice cubes or ice-cold water to the mouth. Oral cryotherapy for chemotherapy-induced stomatitis requires that patients suck on ice chips before, during, and after infusions of mucotoxic drugs.[8] The theory underlying oral cryotherapy is that ice can constrict the blood vessels of the oral cavity membranes; therefore, decreasing exposure of the oral mucosa to mucotoxic agents.[10] Oral cryotherapy is an alternative method of preventing stomatitis associated with chemotherapy agents that have a short half-life in the blood. It is a well-validated, simple, cheep, and effective approach for the prevention of stomatitis. The patient was instructed to keep the ice cubes in their mouth constantly and not to keep them stationary.[11] Oral cryotherapy was initiated 5 min before chemotherapy.

At present, there is no standard precaution to prevent or treat mucositis developed as a side effect of cancer management. Preventive measures directed toward etiology of OM are gaining importance. Preventing a complication beforehand is easier and less costly than treating it. In this context, oral cooling (cryotherapy – using oral ice chips) has become a cheap and readily applicable method in preventing or decreasing OM, developing due to rapid infusion of chemotherapy agents. Cryotherapy causes local vasoconstriction, which in turn reduces the blood flow in oral mucosa and reduces the amount of drug distributed to cells, hence reducing the incidence of OM.

Statement of problem

A study to assess the effectiveness of oral ice cubes on the prevention of OM in patients receiving chemotherapy.

Objectives

The objectives are as follows:

1. To assess the presence of OM among patients receiving chemotherapy before the administration of oral ice cubes
2. To assess the effectiveness of cryotherapy among cancer patients who are receiving chemotherapy
3. To find the association of the presence of OM among patients receiving chemotherapy after administration of ice cubes with their selected personal variables.

Hypotheses

H_1: There will be a significant difference between the pre-test and post-test mean score level of severity of OM among patients receiving chemotherapy

H_2: There will be a significant reduction of severity of OM after ice cube application among patients receiving chemotherapy

H_3: There will be a significant association between the post-test levels of severity of OM among patients with their selected demographic variables.

Research Methodology

The present study was conducted to assess the effectiveness of oral ice cubes in the prevention of OM among cancer patients attending in-patient department at Ashwin Hospital, Coimbatore. The research approach used in this study is the one group approach, and convenience sampling method was used to select samples in the group. To be precise, the research design in the present study was pre-experimental one group pre-test and post-test research design. Pre-test was carried out for all subjects, receive treatment and then post-test was carried out to determine the effectiveness of treatment. The independent variable of the study is oral ice cube application, and the dependent variable in the study was prevention of OM. The attribute variable includes age, sex, educational status, previous occupational status, nature of occupation, supporting system, duration of illness, causes of joint pain, treatments, frequency of health check-up, and associated factors. A total of 30 members were included in the present study, by convenience sampling technique. The sample selection was based on the inclusion criteria like the patients receiving chemotherapy who are willing to participate in the study, who are available at the time of data collection and who are above the years of 18. The exclusion criteria are the patients who are undergoing radiation therapy, who are suffering from head and neck cancer, who are in critical conditions.

Two sections of the tool were used. It consists of demographic characteristics such as age, gender, religion, educational status,

marital status, occupational status, monthly income, habits, type of family, duration of illness, frequency of health check-up, type of drug, diagnosis, associated factors, type of cancer, name of chemotherapy, and oral assessment guide (OAG). Before the application of oral ice cubes, OAG is used for the assessment of oral mucosa. Ice cubes were applied on the oral mucosa before infusing chemotherapy session for 5 min and 20 min after session. Post-test assessment using OAG was done on the 7th day. The scores of the eight categories in OAG are summed. It consists of total 24 scores to assess the oral mucosa. Based on the scores, the severity of OM is calculated as shown in Table 1.

Frequency and percentage distribution was assessed to find the pre-test and post-test level of OM among cancer patients. Paired "*t*" value was assessed to find out the effectiveness of oral ice cube application in the prevention of OM among cancer patients who receive chemotherapy. Area wise comparison of mean, standard deviation, and mean percentage of pre-test and post-test scores of OM among cancer patients was done. Chi-square value of association between post-test scores of OM among cancer patients with their selected demographic variables was assessed.

Results

The frequency and percentage distribution of demographic variables among cancer patients who receive chemotherapy is age, gender, religion, educational status, marital status, previous occupational status, type of family, monthly income, habits and, and duration of illness, frequency of health check-up, diagnosis, chemotherapeutic drug, and associated factors.

Table 2 shows that majority of the population 18 (60%) were in the age group of more than 51 years and the least 1 (3.4%) is in the age group of 26–35 years. Regarding the sex in cancer patients who receive chemotherapy, the majority 18 (60%) were female and 12 (40%) were females. With regard to religious status in cancer patients who receive chemotherapy majority are Hindu 29 (96.6%) and 1 is Christian (3.4%). Regarding the educational status of cancer patients who receive chemotherapy majority 15 (50%) was high school and least 3 (10%) was with pre-university education. With regard to marital status of cancer patients who receive chemotherapy, majority were married 27 (93.1%) and least 1 (3.3%) were widow. With regard to occupational status majority of cancer patients who receive chemotherapy, majority were unemployed 18 (60%) and least were in factory or industrial job 5 (16.6%). Regarding the habits of cancer patients who receive chemotherapy, majority 15 (50%) were with no habits and least 2 (6.7%) were with tobacco chewing habits. Regarding the monthly income of

Table 1: Scoring severity of oral mucositis

Score	Severity of oral mucositis
8	Healthy
9–16	Moderate stomatitis
17–24	Severe stomatitis

Table 2: Frequency and percentage distribution of demographic variables among cancer patients *n*=30

Demographic characters	Chemotherapy receiving patients	
	Frequency	%
Age in (years)		
26–35 years	1	3.4
36–50 years	11	36.6
>51	18	60
Sex		
Male	12	40
Female	18	60
Religion		
Muslim	0	0
Hindu	29	96.6
Christian	1	3.4
Others	0	0
Educational status		
Nonliterate	12	40
High school	15	50
Pre-university	3	100
Graduate	0	0
Marital status		
Unmarried	2	6.6
Married	27	93.1
Widow	1	3.3
Divorce	0	0
Occupation		
Farmer	7	23.4
Factory/industrial	5	16.6
Professional	0	0
Unemployed	18	60
Habits		
Smoking	3	10
Alcohol	10	33.3
Tobacco	2	6.7
Nil	15	50
Monthly income		
<Rs.5000	6	20
Rs.5000–10,000	6	20
Rs.10000–20,000	0	0
Nil	18	60
Type of family		
Nuclear family	14	46.6
Joint family	16	53.4
Duration of illness		
<1 years	22	73.3
1–2 years	6	20
2–3 years	0	0
>3 years	2	6.7
Frequency of check-ups		
Irregular	3	10
Routine check-up	25	83.3
occupationally	2	6.7
Associated factors		
Diabetes mellitus	3	10
Hypertension	4	13.3
Lung disease	-	-
Nil	23	76.7
Type of cancer		
Liver	5	16.6
Abdomen	4	13.4
Cervix	14	46.6
Uterus	7	23.4
Chemotherapy name		
Methotrexate	9	30
5-fluorouracil	21	70

patient who receives chemotherapy, majority were unemployed 18 (60%) and 6 (20%) were with <Rs.5000/- per month income, and another 6 (20%) were in Rs.5000–10,000/- per month income. Regarding the type of family of patients who received chemotherapy, majority were in joint family 16 (53.4%) and 14 (46.6%) were in nuclear family. Regarding the duration of illness of cancer patients who receive chemotherapy, majority were in <1 year 22 (73.3%) and the least 2 (6.7%) were in more than 3 years. Regarding the frequency of check-ups of cancer patients who receive chemotherapy, 25 (83.3%) were in routine check-up and the least 2 (6.7%) were in occasional check-ups. Regarding the associated factors of cancer patients who receive chemotherapy, majority 23 (76.7%) were with no associated factors and the least 3 (10%) were with diabetes mellitus. Regarding the type of cancer, the lowest 4 (13.4%) of the cancer patients were with abdominal cancer, and the highest 14 (46.6%) were with cervix cancer. Regarding the type of chemotherapeutic drug, 4 (30%) were treated with Inj. Methotrexate and 21 (70%) were treated with 5-fluorouracil (5-FU).

It is inferred that majority of the cancer patients who received chemotherapy were in the age group of more than 51 years, were females, were with high school education, were unemployed, were in joint family status, were with regular check-ups, were married, and were with no habits.

Table 3 shows the frequency and percentage distribution of level of OM among the cancer patients who receive chemotherapy before and after application of oral ice cubes depicts that, in pre-test, 100% (30) of the cancer patients were with healthy oral mucosa. In the post-test, 73.3% (22) of cancer patients were with healthy oral mucosa and only 26.7% (8) were with moderate OM. The paired "*t*" test value is 3.3 for healthy mucosa and 2.17 for moderate mucositis. There was no evidence of severe mucositis. The overall mean percentage score for pre-test was 100% whereas in post-test it was 73.25% revealing a difference of 26.75%.

Table 4 shows that in the pre-test, the highest mean score was 8 ± 0 and in the post-test the mean score was 5.86 ± 3.59. In the area of moderate OM pre-test mean score was 0 and for the post-test mean score was 3.13 ± 5.39. The overall mean percentage score for pre-test was 100% whereas in post-test it was 73.25%.

Discussion

OM is a common symptom effect of radiation and chemotherapy. It is defined as an inflammation of oral mucosa resulting from cancer therapy typically manifesting as atrophy, swelling, erythema, and ulceration.[9]

It has a serious impact on those who are undergoing cancer treatment. It will affect treatment schedule by delay or discontinued treatment, quality of life and aspects of daily living.[12]

The study findings are discussed in this chapter with reference to the objectives and hypotheses as stated for the discussion.

The study finding showed that the majority (60%) of the samples were females and 60% of the samples were in the age group of more than 51 years. While assessing the illness status, the majority of the samples were with cervix cancer (46.6%), were treated with 5-FU (70%), and on regular check-ups (83.3%).

The first objective is to assess the level of OM among patients receiving chemotherapy before and after the application of oral ice cubes. Frequency and Percentage distribution was assessed to find the pre-test and post-test level of oral mucositis among cancer patients. In the pre-test, 100% of the cancer patients were with healthy oral mucosa. In the post-test, 73.3% of cancer patients were with healthy oral mucosa and only 26.7% were with moderate oral mucosa. There is no evidence of severe mucositis on the 7th day of post oral ice cube application. It seems that application of oral ice cube reduces the incidence of OM. There is a significant difference between the pre-test and post-test score of level of OM among cancer patient who receives chemotherapy. Hence, hypothesis is accepted.

Table 3: Frequency of percentage distribution of pre- and post-test score of oral assessment

Areas	Pre-test		Post-test		Paired "*t*" Value	Table value
	Frequency	%	Frequency	%		
Healthy	30	100	22	73.3	3.3	2.05
Moderate	0	0	8	26.7	2.17	2.05
Severe	0	0	0	0	-	-

Table 4: Mean and standard deviation of pre- and post-test scores of oral assessment

Oral assessment guide	Max. scores	Cancer patients					
		Pre-test			Post-test		
		Mean	SD	Mean %	Mean	SD	Mean %
Healthy	8	8	0	100	5.86	3.59	73.25
Moderate stomatitis	16	0	0	0	3.13	5.39	19.56
Severe stomatitis	24	0	0	0	0	0	0
Total		8	0	100	9	2.01	37.5

A study described that symptomatic relief from mouth pain can be 66 achieved by sucking ice chips when the chemotherapy drug is most concentrated in the body. This technique, called cryotherapy, works by decreasing blood flow to sores.[13]

The effects of local cryotherapy on mucositis incidence administrated during 5-FU treatment. Among a total of 99 courses, 5-FU and folinic acid combination chemotherapy were given to 40 patients. Cryotherapy was given to the same patient in one course but not given in the next. Findings revealed that while mucositis developed in 6.7% of the courses given with cryotherapy, this ratio was 38.9% in courses given without cryotherapy. In the logistic regression analysis, development of mucositis had been found to correlate only with cryotherapy. Odds ratio = 11.5; in the 95% confidence interval = 3.2–41.9; ($P = 0.001$). They concluded that oral cooling prevents 5-FU induced mucositis. This effective prophylactic treatment should be used in patients who are at increased risk of developing 5-FU induced mucositis.[14]

The second objective is to assess the effectiveness of oral ice cube application among cancer patients who receive chemotherapy. Paired "*t*" test value was assessed to find the effectiveness of oral ice cube application in prevention of oral mucositis among cancer patients who receive chemotherapy. The paired "*t*" values were 3.3 for healthy mucosa, 2.17 for moderate mucositis there was no evidence of sever mucositis. All the "*t*" values are high when compared to table value 1.699. It seems that there is significant effect of oral ice cube application in reduction of OM.

A retrospective study among 39 patients undergoing cisplatin-based chemotherapy regimen. The patients were divided into two groups, a case group (24 individuals) having received 47 cycles of cisplatin-based 67 chemotherapy in addition to surgery, and a control group (15 individuals) treated with surgery alone. The study revealed that 62% of the patients in the chemotherapy group developed adverse soft tissue reactions, with mucositis and pain as chief complaints, whereas none in the control group experienced any mucosal complications.[15]

According to BioMedical Centre of Oral Health, OM is multifactorial in nature. The disruption or loss of rapidly dividing epithelial progenitor cells is a trigger for the onset of the disorder. However, the actual manifest dysfunction and its severity and duration are greatly influenced by changes in other cell populations, immune responses, and the effects of oral flora. This toxicity frequently complicates the course of autologous bone marrow transplantation; it causes severe pain as well as cramping, nausea, and gastro-enteritis. In addition, food and fluid intake may be poor, the ability to absorb nutrients much reduced and the susceptibility to infection greatly increased. The nature and degree of mucositis experienced by a patient vary according to the treatment regimen applied (combination of radiotherapy and chemotherapy, dosage, duration, and sequence). Mucositis can, therefore, result in under-nutrition and significantly decreases a patient's quality of life. Modulation of the treatment regimen (use of lower doses or long recovery intervals between doses) remains the most effective means of limiting the actual incidence and severity. This event can, therefore, compromise patient prognosis.

Comparison of mean, standard deviation, and mean percentage of pre-test and post-test scores of level of OM among cancer patients who receive chemotherapy shows that in healthy mucositis the pre-test mean score was 8, which is 100% and the post-test mean score was 5.86 (3.59) which are 73.25%. It reveals the difference of 26.75%. In moderate mucositis, pre-test mean score was 0. The post-test mean score was 3.13 (5.39) which is 19.56%. It reveals the difference of 19.56%. In sever stomatitis, pre-test mean score was 0 and post-test mean score was 0. Hence, the overall pre-test mean score was 8 (0) which is 100% and the overall post-test mean score was 9 (2.01) which is 37.5%. It shows the difference of 70.8%. It seems that the oral ice cube application is effective in the prevention of OM among cancer patients who receive chemotherapy. There is significant effectiveness of oral ice cubes on the prevention of OM among cancer patients who receive chemotherapy. Hence, this hypothesis is accepted.

Cascinu conducted arandomized study that demonstrated the utility of oral cooling (cryotherapy) in the prevention of 5-FU-induced stomatitis. To verify these results a confirmatory study, using identical treatment regimen was initiated. Eighty-four patients treated with a 5-FU-containing regimen were randomized to a control arm or to receive oral cryotherapy. Endpoint evaluation was obtained by a global assessment of the physician's judgment and patients' description of mucositis severity graded 0–4. Mucositis was significantly reduced by cryotherapy considering both the first cycle of therapy (the mean toxicity score for cryotherapy was 0.59, and it was 1.1 for the control group, $P > 0.05$) and all the chemotherapeutic courses (the mean toxicity score for cryotherapy was 0.36 when it was 0.69 for the control group, $P > 0.05$). In conclusion, the present study confirms that cryotherapy can decrease 5-FU-induced stomatitis and should be recommended for patients receiving bolus 5-FU containing regimens.[16]

It has been hypothesized that topical administration of ice chips to the oral cavity during the administration of chemotherapy results in decreased delivery of the chemotherapeutic agent to the oral mucosa. This effect is presumably mediated through local vasoconstriction and reduced blood flow. Several studies have demonstrated that cryotherapy reduces the severity of OM in patients receiving bolus doses of chemotherapeutic agents.[17]

The third objective is to find the association between post-test scores of level of OM among cancer patients who receive chemotherapy and their selected demographic variables. Chi-square was calculated to find out the association between the post-test scores of level of OM among cancer patients who receive chemotherapy with their selected demographic variables. It reveals that there was a significant association ($P > 0.005$) found between the post-test scores OAG and demographic variable like frequency of check-ups. There was no significant association ($P < 0.05$) found between post-

test score level of OM among cancer patients who receive chemotherapy when compared to other demographic variables such as age, gender, religion, educational status, marital status, and causes of illness. There is a significant association between post-test score of OM among cancer patients who receive chemotherapy and their selected demographic variables. Hence, this hypothesis is accepted.

According to oralcancerfoundtation.org, OM is probably the most common, debilitating complication of cancer treatments, particularly chemotherapy and radiation. It can lead to several problems, including pain, nutritional problems as a result of the inability to eat, and increased risk of infection due to open sores in the mucosa. It has a significant effect on the patient's quality of life and can be dose-limiting (i.e., requiring a reduction in subsequent chemotherapy doses). Factor that can increase the likelihood of developing mucositis or that can make it worse if it does occur, including habit of tobacco chewing.

Conclusion

This study shows that the oral ice cube application has a significant contribution to the protection of oral health by preventing OM. Oral ice cube application can be included in the nursing care of cancer patients who receive Chemotherapy. Nurse's awareness can promote patient care and options for resolving problems will enable them to provide a higher standard of individualized care.

References

1. Cheng AC, Chengo MK. Oral care for children with leukemia. HKM J 2009;6:203-8.
2. Eilers J, Million R. Clinical update: Prevention and management of oral mucositis in patients with cancer. Semin Oncol Nurs 2011;27:e1-16.
3. Eilers J. Nursing interventions and supportive care for the prevention and treatment of oral mucositis associated with cancer treatment. Oncol Nurs Forum 2004;31:13-23.
4. Thurgood G. Nurse maintenance of oral hygiene. Br J Nurs 1994;3:332- 4, 351-3.
5. Lilleby K, Garcia P, Gooley T, McDonnnell P, Taber R, Holmberg L, *et al.* A prospective, randomized study of cryotherapy during administration of high-dose melphalan to decrease the severity and duration of oral mucositis in patients with multiple myeloma undergoing autologous peripheral blood stem cell transplantation. Bone Marrow Transplant 2006;37:1031-5.
6. Goldberg SL, Chiang L, Selina N, Hamarman S. Patient perceptions about chemotherapy-induced oral mucositis: Implications for primary/secondary prophylaxis strategies. Support Care Cancer 2004;12:526-30.
7. Svanberg A, Ohrn K, Birgegård G. Oral cryotherapy reduces mucositis and improves nutrition a randomised controlled trial. J Clin Nurs 2010;19:2146-51.
8. Harris DJ, Eilers J, Harriman A, Cashavelly BJ, Maxwell C. Putting evidence into practice: Evidence-based interventions for the management of oral mucositis. Clin J Oncol Nurs 2008;12:141-52.
9. Sonis ST, Elting LS, Keefe D, Peterson DE, Schubert M, Hauer-Jensen M, *et al.* Perspectives on cancer therapy-induced mucosal injury: Pathogenesis, measurement, epidemiology, and consequences for patients. Cancer 2004;100:1995-2025.
10. Nikoletti S, Hyde S, Shaw T, Myers H, Kristjanson LJ. Comparison of plain ice and flavoured ice for preventing oral mucositis associated with the use of 5 fluorouracil. J Clin Nurs 2005;14:750-3.
11. Worthington HV, Clarkson JE. Prevention of oral mucositis and oral candidiasis for patients with cancer treated with chemotherapy: Cochrane systematic review. J Dent Educ 2002;66:903-11.
12. Brown C. Cancer Nursing Principles and Practice. 7th ed. Burlington: Jones and Bartlett Learning; 2010. Available from: http://www.hsag.co.za/index.php/HSAG/article/view/632/751. [Last accessed on 2019 Sep 22].
13. Heydari A, Sharifi H, Salek R. Effect of oral cryotherapy on combination chemotherapy-induced oral mucositis: A randomized clinical trial. Middle East J Cancer 2012;3:55-64. Available from: http://www.cancer.unm.edu/cancer/cancer-info/cancer-treatment/side-effects-ofcancer-treatment/common-side-effects/mouth-sore. [Last accessed on 2019 Sep 22].
14. Baydar M, Dikilitas M, Sevinc A, Aydogdu I. Prevention of oral mucositis due to 5-fluorouracil treatment with oral cryotherapy. J Natl Med Assoc 2005;97:1161-4.
15. Herlofson BB, Norman-Pedersen K, Redfors M, Fosså SD. Oral mucosal side effects of cytotoxic chemotherapy of testicular cancer. A retrospective study. Eur J Oral Sci 1997;105:523-6.
16. Cascinu S, Fedeli A, Fedeli SL, Catalano G. Oral cooling (cryotherapy), an effective treatment for the prevention of 5-fluorouracil-induced stomatitis. Eur J Cancer B Oral Oncol 1994;30B:234-6.
17. Lalla RV, Sonis ST, Peterson DE. Management of oral mucositis in patients who have cancer. Dent Clin North Am 2008;52:61-77, 8.

How to cite this article: Bai RR. Effectiveness of Oral Ice Cube Application on Prevention of Oral Mucositis among Cancer Patients Who Receive Chemotherapy. Innov J Nurs Healthc. 2019;5(3):38-43.