

# Correlation of oral health of children with acute leukemia during the induction phase

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## ABSTRACT

**Background:** Treatment of acute leukemia's- a common childhood malignancy, involves intensive and powerful multi-drug chemotherapeutic regime. Oral lesions are a common complication in these patients affecting oral health status. **Aim:** This study was conducted to evaluate and assess the oral health status of newly diagnosed leukemic pediatric patients during induction phase and its correlation to outcome of induction therapy. **Material Methods:** Oral examinations was done in 33 children between the age group of 5-15 years with acute lymphoblastic leukemia (ALL) and acute myeloblastic leukemia (AML), who were undergoing chemotherapy. Oral Hygiene Index- Simplified, (OHI-S) decayed missing filled teeth index (def/DMFT), Loe and Sillness index for gingiva, and complete blood count at first and fourth week of induction phase were recorded for each patient. The changes in the oral health status were analyzed with Wilcoxon signed rank test. **Results:** During an induction phase it was observed that level of OHI-S ( $P = 0.002$ ), Loe and Sillness index ( $P = 0.003$ ), def/DMFT index ( $P = 0.076$ ), platelet count ( $P = 0.00$ ) increased significantly and no significant difference was noted in hemoglobin ( $P = 0.4$ ) and total leucocytes count ( $P = 0.11$ ). **Conclusion:** It was observed that, although oral health status had significantly worsened, the induction outcome was not affected.

**Key words:** Induction phase, leukemia, oral hygiene, oral lesions

## INTRODUCTION

Acute leukemia is the most common childhood cancer representing 24% of all childhood malignancies.<sup>[1]</sup> The treatment regimen includes multi-agent chemotherapy (three phases: induction therapy, intensification therapy, maintenance therapy) and central nervous system directed radiotherapy. Immune suppression caused due to disease, and its therapy makes these children more prone to infections with severe stomatologic complications.<sup>[2]</sup>

The most common complications are mucositis, xerostomia, bleeding, dysgeusia and infections leading to pain, discomfort and interfere with the course and prognosis of the neoplasm.<sup>[3]</sup>

The study was planned to study the oral manifestations in pediatric population with acute leukemias during the induction phase only.

## Aims and objectives

1. To study the oral manifestation of acute leukemia during induction chemotherapy.
2. To analyze the level of oral hygiene and find its correlation with induction outcome (short come outcomes in the form of increased febrile neutropenic episodes, induction deaths, number of admissions).

## MATERIALS AND METHODS

This was a cross-sectional noninvasive study. Thirty three patients both sexes age range (5-15 years) in pediatric oncology unit with diagnosis of acute lymphoblastic leukemia and acute myeloblastic leukemia were the subjects for the study. They were admitted for undergoing chemotherapy induction treatment at the institute.

These patients were examined thoroughly for any signs and symptoms of oral diseases. Single clinician (dental surgeon) performed oral examination of children at the 1<sup>st</sup> week of induction and 4<sup>th</sup> week of induction of chemotherapy. Patients who have completed first induction phase or those who were on maintenance therapy were excluded from the study. The parents/

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responsible guardians were informed and explained about the aim and character of the study. Patients were evaluated after obtaining an informed consent.

Dental mouth mirror and diagnostic probe were used to conduct simple observational examination. Patients were evaluated for, oral hygiene by using “oral hygiene index-simplified (OHI-S)” [Table 1a, b], dental caries by using “def index” and “decayed missing filled teeth (DMFT) index,” [Table 2] and gingival findings by using “Loe and Silness index” [Table 3].<sup>[4,5]</sup> The patients were also scrutinized for any other findings or lesions in the oral cavity, i.e., lesion including site and size of the lesion, candidiasis, any other infections as herpes simplex virus, varicella zoster virus, *Cytomegalovirus*, acute necrotizing and ulcerative gingivitis.

**Simplified OHI calculation**

Debris index: debris is defined as soft, foreign matter consisting of bacterial plaque and food debris. The criteria include:

**Table 1a: Debris Index (DIS)**

Scores	Criteria
0	No debris or stain present
1	Soft debris covering not more than one-third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered
2	Soft debris covering more than one-third, but not more than two-thirds, of the exposed tooth surface
3	Soft debris covering more than two-thirds of the exposed tooth surface

**Table 1b: Calculus Index (CIS)**

Scores	Criteria
0	No calculus present
1	Supragingival calculus covering not more than third of the exposed tooth surface
2	Supragingival calculus covering more than one-third but not more than two-thirds of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both
3	Supragingival calculus covering more than two-third of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth or both

**Table 2: DMFT index**

Code	Scores	Criteria
	0	Natural tooth without any decay/filling
D	1	Decayed tooth
E	1	Extracted or indicated for extracted tooth (due to caries)
F	1	Permanently filled tooth

**Table 3: Gingival index of Loe and Silness**

Scores	Gingival Status	Criteria
0	Normal gingiva	Natural coral pink gingival with no e/o inflammation
1	Mild inflammation	Slight changes in color, slight edema. No bleeding on probing
2	Moderate inflammation	Redness, edema and glazing. Bleeding upon probing
3	Severe inflammation	Marked redness and edema/ulceration/tendency to bleed spontaneously

The same examination was again carried out in the 4<sup>th</sup> week of the induction phase. All the scores and observations were recorded in a diagnostic chart along with the brief patient’s history and complete blood count on the day of observation. The suspected focus of infections in oral cavity was cultured as a routine process. These reports were collected and co-related with short term outcomes such as febrile/neutropenic episodes/morbidity/mortalities with the help of routine blood culture reports.

The changes in the oral health status were being observed during first week and fourth week and were analyzed with Wilcoxon’s signed rank test. All tests were non-parametric and conducted at a 5% significance level. The indices scores were converted in to percentage scale. For this pilot study, a cut-off criteria has been set as 50% for oral hygiene, gingival and def/DMFT index.

**RESULTS**

A total of 23 male and 10 female patients with acute leukemia were studied prospectively. We found that the dental status namely the gingival and periodontal tissues were affected in this period due to lack of good oral hygiene and overall poor health status following chemotherapy [Table 1]. 15 out of 30 (50%) subjects showed increase in “OHI-S,” “Loe and Silness gingival index.” A significant change was observed in these indices ( $P = 0.002$ ;  $0.003$ , respectively). def/DMFT index finding showed increase of 33% [Table 4]. There were no extractions or dental filling done; the decay factor was mainly noticed in this period. Poor oral hygiene, in these patients has led to increase caries activity.

Table 5 shows hematological finding pre- and post-induction phase. No significant difference was noted in hemoglobin, total leucocytic count, or absolute neutrophil count ( $P = 0.4$ ;  $0.11$ ;  $0.53$  respectively), but highly significant difference was seen in platelet count  $P < 0.05$ .

In this study, no interruptions in induction chemotherapy was reported due to dental infections. Three patients

**Table 4: Dental finding pre- and post-induction phase**

Variables	Increased (%)	Mean		Median		P value
		I <sub>1</sub>	I <sub>2</sub>	I <sub>1</sub>	I <sub>2</sub>	
OHI	15 (50)	1.06	1.58	1	1	0.002
GI	15 (50)	0.21	0.62	0.0	0.5	0.003
Def/DMFT	10 (33)	2.3	2.70	1.5	2	0.076

I<sub>1</sub> – First induction phase; I<sub>2</sub> – Second induction phase; OHI – Oral hygiene index; GI – Gingival index; DMFT – Decayed missing filled teeth

**Table 5: Hematological finding pre- and post-induction phase**

Variables	Increased (%)	Mean		Median		P value
		I <sub>1</sub>	I <sub>2</sub>	I <sub>1</sub>	I <sub>2</sub>	
Hb	14	8.57	8.42	8.7	8.35	0.4
TLC	8	21.64	11.05	3.63	2.83	0.11
Platelet	26	51.39	137.2	26	74	0.0
Absolute neutrophil	11	5.58	1.86	0.51	0.67	0.53

I<sub>1</sub> – First induction phase; I<sub>2</sub> – second induction phase; Hb – Hemoglobin; TLC – Total leucocytes count

expired due to debilitating general health, but not due to induction therapy.

Oral lesions were found in 2 subjects who were under induction. Palatal aphthous ulcer was observed in a child and it was 1.5 cm diameter in size. In another subject angular cheilitis was noted. All the remaining subjects presented no clinical signs of oral lesion. As a regular protocol the suspected foci of infection was cultured and it was found to be candida in angular cheilitis. In the second case of aphthous ulcer neutropenia was noticed as a cause.

## DISCUSSION

Leukemia is a disease resulting from the malignant transformation of stem cells whose proliferation starts in the bone marrow. This type of cancer most frequently affects children.<sup>[6,7]</sup>

Oral complaints precipitated by the side-effects of the antineoplastic agents are primarily those of discomfort, sensitivity of teeth and pain, ulceration, gingival hemorrhage, dryness and impaired taste sensation.<sup>[8-11]</sup> Mucositis is most common but reversible finding of these patients. Maintenance of oral hygiene is the basic preventive aid from all kinds of oral infections. But in induction phase of leukemia treatment, the platelet and neutrophil count decreases. Patients are advised against any vigorous mechanical dental cleansing aid (tooth brush/floss/interdental cleaning aids) to avoid triggering of any bleeding episodes. An alkaline saline rinse of warm water flavored with salt and sodium bicarbonate is recommended for oral cleansing.<sup>[12]</sup>

Gingiva reacts differently to even slight amount of plaque if subject is on anti-neoplastic therapy for blood dyscrasias.

In the present study, it was observed that the OHI-S count was increased in 50% of individuals. This change in OHI-S definitely affects other oral hard and soft-tissues. Inflammation in the gingiva is most common and probably earliest presentation of changes in oral tissues due to plaque.

The increased scores of GI in 50% of individuals clearly highlight the problems associated oral hygiene maintenance in these patients. The gingival inflammation, if not treated leads to periodontal problems and may eventually lead to loss of teeth in adult patients.

DMFT/def index was found to be increased in 10 patient's, i.e., 33% of study population. Since no active dental treatment is advocated (advisable) to any patient undergoing induction therapy, the difference in DMFT was only in D, i.e., decay component of the DMFT. This suggests that 33% individuals got affected with caries during induction phase. Although the induction therapy drugs are not directly responsible for the decay process, the change in oral environment due to excess plaque accumulation and/or change in quality and quantity of saliva due to drugs might have played important role in increased in caries process.

In most of the patient's erythematous oral mucosa, burning sensation of mouth was common, since mucositis was not primary objective of this study, the findings were not noted. One subject demonstrated an aphthous ulcer on palatal mucosa but it responded well to the symptomatic therapy. In another subject, angular cheilitis was seen. The angular cheilitis is generally a clinical sign of an inflammatory response to fungal infection. There was no statistical significant difference was observed in terms of short term outcomes of leukemia therapy due to dental problem.

## CONCLUSION

In this study, it was observed that the oral health status worsened following first induction chemotherapy in acute leukemic pediatric patients. There was a significant increase in level of OHI, gingival index and def/DMFT. Lesions like aphthous ulcer and angular cheilitis were noticed in two of the subjects while other subjects did not have any oral complications.

These finding suggest that there is a need to institute optimum oral health, during and in between induction phases. Poor oral health did not affect the induction

outcome in this study. Further study is study with larger sample size is needed to conclude the role of oral hygiene in the induction outcome of pediatric patients receiving treatment for acute leukemia.

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