

Effect of low level helium-neon (He-Ne) laser therapy in the prevention & treatment of radiation induced mucositis in head & neck cancer patients

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Background & objectives: Oral mucositis is a common debilitating complication of radiotherapy occurring in about 60 per cent of cancer patients. Considerable buccal toxicity of radiotherapy or chemotherapy in cancer patients to become discouraged and can affect their quality of life. In addition, such toxicity can alter the treatment plan. At present, there is no clinically appropriate prophylaxis efficacious antidote for mucositis. The low level laser (LEL) appears to be a simple, non-traumatic technique for the prevention and treatment of radiation induced mucositis. Therefore the present study was carried out to find out the effect of low-level helium-neon (He-Ne) laser in the prevention and treatment of radiation induced mucositis in head and neck cancer patients.

Methods: The patients with carcinoma of oral cavity with stages II-IV a being uniformly treated with curative total tumour dose of 66 Gy in 33 fractions over 6 wk were selected for the study. The patients were divided based on computer generated randomization into laser (study group) and control groups with 25 patients in each group. Both study and control groups were comparable in terms of site of the lesion, stage of the cancer and histology. The study group patients were treated with He-Ne laser (wavelength 632.8 nm and output of 10mW) and control group patients were given oral analgesics, local application of anaesthetics, 0.9 per cent saline and povidine wash during the course of radiotherapy.

Results: All patients tolerated the laser treatment without any adverse effect or reactions. The result showed a significant difference in pain and mucositis ($P<0.001$) between the two groups. At the end of radiotherapy (after 6 wk) mean pain score and mucositis grade were significantly lower ($P<0.001$) in the study group compared to control.

Interpretation & conclusion: The low-level He-Ne laser therapy during the radiotherapy treatment was found to be effective in preventing and treating the mucositis in head and neck cancer patients. Further studies need to be done on a larger sample to find the mechanism.

Key words He-Ne laser therapy - oral cancer - oral mucositis - radiotherapy induced

Oral mucositis also called stomatitis, is a common debilitating complication of chemotherapy and radiotherapy occurring in about 60 per cent of cancer patients. Oral mucositis is inflammation of the mucosa of the mouth, which ranges from redness to severe ulceration. The symptoms of mucositis vary from pain and discomfort to an inability to tolerate food or fluid. Mucositis may also limit the patient's ability to tolerate either chemotherapy or radiotherapy, so that mucositis may delay the treatment and limit the effectiveness of cancer therapy. The mucositis may affect patient's gum and dental conditions, speech and self-esteem are reduced, further compromising patient's response to treatment and palliative care. Considerable buccal toxicity of radiotherapy or chemotherapy can cause cancer patients to become discouraged and can also affect their quality of life. In addition, such toxicity can alter the treatment plan. At present, there is no clinically appropriate prophylaxis and efficacious antidote has not been found for mucositis¹. It is therefore important that mucositis is prevented whenever possible or at least treated to reduce its severity and possible complications.

The use of low level laser (LEL) appears to be a simple, non-traumatic technique for prevention and treatment of radiation induced mucositis. The irradiation by LEL corresponds to local application of high photon density monochromatic light source. The LEL leads to activation of epithelial healing. While LEL used for the treatment or prevention of mucositis has some evidence supporting its use¹ but this intervention has not been conclusively validated by research in India. Therefore the present study was undertaken to find out the effect of low-level helium-neon (He-Ne) laser in the prevention and treatment of radiation induced mucositis in head and neck cancer patients.

Material & Methods

A prospective study was conducted at Shridi Sai Baba Cancer Hospital and Research Centre, MAHE University, Manipal, from January 2003 to January 2004.

Patients characteristics: All patients with carcinoma of oral cavity with stages II-IV a being uniformly treated with curative total tumour dose of 66 Gy in 33 fractions over 6 wk were selected for the study. The ethical clearance was obtained from the ethics committee of the University and informed consent was taken from patients before the commencement of study. The patients with associated systemic complications were excluded. The patients were divided based on computer generated randomization into laser (study group) group and control group with 25 patients in each group. Both study and control groups were comparable in terms of site of the lesion, stage of the cancer and histology. At the beginning of the study, there was no oral mucositis in patients of both the groups and hence no pain at the oral cavity. The mean age (\pm SD) of patients in the study group was 54 ± 1 yr and that of control group was 53 ± 1 yr, and the male female ratio was 2:1.

The study group patients treated with He-Ne laser (wavelength 632.8 nm and output of 10 mW (Electro care Ltd. Laser 2001, India) were given intra-orally outside the malignant tumour located area, three minutes for five days a week till the completion of radiotherapy. The patients were given oral analgesics in addition to the laser therapy. The laser was irradiated to posterior third of the internal surfaces of the cheeks, soft palate, anterior tonsillar pillars, separately. The treatment time (t) for each application point was given by equation $t(\text{sec}) = \text{energy} (\text{J}/\text{cm}^2) \times \text{surface area} (\text{cm}^2) / \text{Power} (\text{W})$. The average energy density of $1.8 \text{ J}/\text{cm}^2$ was delivered to the treatment area.

The control group patients were treated with oral analgesics and local application of anaesthetics, 0.9 per cent saline and povidine wash during the course of radiotherapy. Physician blinded to the type of treatment using WHO scale for mucositis² and visual analogue scale for pain evaluation³ recorded the objective assessment of the degree of mucositis weekly. The laser therapy was given from day 1 till the completion of radiotherapy and there was no drop out in both study and control group.

In the WHO scale for mucositis assessment grades 0-4 were given according to symptoms, grade 0-no symptom; 1- sore mouth, no ulcers; 2- sore mouth with ulcers, but able to eat normally; 3- liquid diet only; and 4- unable to eat or drink.

Statistical analysis: The pain score and mucositis grade were compared between the groups at the end of radiotherapy by non-parametric Mann-Whitney test for pain score and descriptive cross tabulation for mucositis grade. $P < 0.05$ was considered significant.

Results & Discussion

All patients tolerated the laser treatment without any adverse effect or reactions. The analysis showed a significant difference in pain and mucositis between the groups. At the end of radiotherapy (after 6 wk) mean pain rank in study group showed significant decrease ($P < 0.001$) as compared to control group (Table). Mean pain score in study group showed significant decrease in the mean pain score (2.6 ± 0.64) as compared to control group (6.68 ± 1.44) ($P < 0.001$).

At the end of radiotherapy, the mucositis grade was significantly ($P < 0.001$) lower in the study group than in control group. Mucositis grade was 1.72 ± 0.67 in the study group and 3.32 ± 0.69 in control group. Eighteen patients in study group had grade 1 and seven had grade 2 mucositis. In the control group 14 had grade 3 and 11 grade 4, mucositis.

The head and neck cancer is one of the most common malignancies and a frequent cause of cancer related death among men and women in India. The

squamous cell carcinoma accounts for 90 per cent of carcinoma that occur in the oral cavity, pharynx and larynx¹. Usually patients treated with external radiotherapy suffer oral mucositis as one of the most common complications. The management of oral mucositis is currently directed primarily at palliation of the symptoms and prevention of infections. Currently no therapy is available for oral mucositis. Low level He-Ne laser has been reported to be effective in reducing the severity of oral mucositis lesions in a non-randomized trial⁴.

Low intensity laser photostimulation has been used as a treatment modality for various medical problems including wound repair processes, musculoskeletal complications, and pain control^{5,6}. Clinical studies have shown low energy lasers to be effective as analgesics, and to accelerate the healing of injured tissue⁷⁻¹¹. We conducted this study to find out its efficacy on radiation-induced mucositis in head and neck cancer patients. During the study, no adverse effects were noted with the use of low-level He-Ne laser application. However, it is important to emphasize the use of wavelength specific goggles during the laser application for both patients as well as treating physiotherapist for preventing retinal damage by laser.

Our results showed that laser therapy was effective in reducing mucositis and pain in the patients at the completion of radiotherapy. We also observed that the patients in control groups were given Ryles tube feeding due the severity of mucositis, but the study group patients were able to take the liquid oral feed with out pain. The laser application delayed the time of onset, attenuated the peak severity and shortened the duration of oral mucositis⁴. The possible mechanism could be due to the anti-inflammatory and analgesic effect of the laser irradiation on the local tissue, which in turn increases the vascularity, and re-epithelization of injured tissue. In oral tissues the laser applications could stimulate DNA synthesis in myofibroblasts, without degenerative changes, and could transform fibroblasts into myofibroblasts, which may promote

Table. Comparison of pain scale in the two groups at the end of radiotherapy

Group (N)	Mean rank	Sum of ranks
Study (25)	13	325
Control (25)	38	950

$P < 0.001$ between the groups (Mann-Whitney test)

and activate the epithelial healing of mucosa¹¹. Another mechanism that has been proposed for pain relief is the modulation of pain perception by modification of nerve conduction via release of endorphins and enkephalins³.

In conclusion, the low-level He-Ne laser therapy during the radiotherapy treatment was found to be effective in preventing and treating the mucositis in head and neck cancer patients. Extensive clinical research is required to prove the effectiveness of laser in preventing and treating oral mucositis in head and neck cancer patients.

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