The effects of laser irradiation on proliferation in osteosarcoma cell lines (MG63 and U2OS)

Author
Laakso, Liisa, Renno, Ana Claudia, McDonnell, Ann, Parizotto, Nivaldo

Published
2007

Conference Title
World Physical Therapy 2007

Copyright Statement
Copyright remains with the authors 2007. The attached file is reproduced here with permission of the copyright owners for your personal use only. No further distribution permitted. For information about this conference please refer to the publisher’s website or contact the authors.

Downloaded from
http://hdl.handle.net/10072/18062

Link to published version
http://www.wcpt.org/node/29497
INTRODUCTION

Low level therapy (LLLT) has been used as a treatment in many clinical conditions with particular application for pain, post-injury inflammation and tissue healing. The action of laser therapy is based on the absorption of light by tissues, generating a series of modifications in cell metabolism. Once absorbed, the light can modulate cell biochemical reactions and stimulate mitochondrial respiration, with the production of molecular oxygen and ATP synthesis. These effects are known to increase the synthesis of DNA, RNA and cell-cycle regulatory proteins, thus promoting cell proliferation.

The effects of laser irradiation have also been investigated in malignant cells. From a physiotherapy perspective, this is an important investigative path to follow particularly when considering the safety and efficacy of LLLT in the oncology population of patients who may have indications for LLLT but for whom the treatment may be precluded by the proximity of an existing tumor or a relevant past history of cancer.

While there appears to be no evidence that LLLT has a carcinogenic effect, there is accumulating evidence to suggest that LLLT has a biostimulatory effect in tumor cells. However, the exact mechanism by which laser acts on malignant cells is not fully understood and, for many, the use of LLLT as a treatment modality is still controversial.

In order to progress our understanding of the physiological processes and clinical parameters involved in the application of laser therapy, and to determine the responses of malignant bone cells to laser irradiation, we investigated the dose-response effects of 670nm, 780nm and 830nm laser on cell proliferation in two different osteosarcoma (MG63 and U2OS) cell lines in vitro.

METHODS

Cell lines were grown and passaged using standard aseptic tissue culture protocols. For laser irradiation, 96-well plates were seeded with 1x10⁴ cells in fresh growth medium, then incubated for 24h at 37°C in 5%CO₂. A single dose of laser was applied (670nm, 780nm and 830nm at 30mW) (Figure 1) at the intensities of 0.5, 1, 5 and 10 J/cm². Cell proliferation was assessed 24h after treatment by colorimetric processes and clinical parameters involved in the subsequent effects on RNA synthesis. Such effects may alter the expression of various cell regulatory proteins (Stein et al., 2005) and contribute to the results noted in our research and that of others.

The results obtained in our study may be due to cell specific effects of LLLT as well as the LLLT wavelengths and doses utilised. Differences in the biochemical physiology of the MG63 osteosarcoma line compared to the U2OS osteosarcoma line may account for the results and as such have important implications for careful selection of laser parameters in clinical application with particular attention to histological findings. Our group continues to investigate the mechanisms and effects of LLLT on malignant cell lines.

CONCLUSION

The results of the present study demonstrate that laser irradiation has stimulatory effects on osteosarcoma cell proliferation. However, these data highlight that different osteosarcoma cell lines have varying responses to different types of laser and parameters utilised. Further investigations are required to investigate possible response mechanisms that may explain the outcomes obtained when examining laser irradiation of cultured cells. Such future studies will undoubtedly contribute to a better understanding of the safety and efficacy of LLLT in clinical oncology.

REFERENCES


This work was supported by CAPES / Brazil.