

Final Report Summary

Photo Activated Disinfection



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The work carried out here examines the feasibility of further developing photo activated disinfection, a treatment currently used in dentistry. This project looks at adapting the technology for use in other medical applications such as the disinfection of surgical instruments and implants. The investigation was carried out by Denfotex Ltd. and the University of Dundee.

Denfotex Ltd. has developed photo activated disinfection to kill dental bacteria in caries and endodontics. The technology uses a laser of 635nm wavelength and toluidine blue O (TBO) dye. TBO dye and the laser light are non toxic to bacteria if applied individually, however when combined they can very effectively kill rapidly multiplying micro organisms. The technique does not cause damage to healthy tissue unlike more conventional disinfectants as the activation produces singlet oxygen which disrupts only the bacterial membrane.

Many high tech medical and surgical devices cannot be disinfected by standard techniques such as autoclaving. Another problem area is that there can be high infection rates associated with surgical implants. Photo activated disinfection could be used to disinfect complex medical devices and medical implants both ex vivo, before implantation and in vivo when an infection has occurred.

Project Aims

The aims of the project were to:

- Carry out initial investigations into the current photo activated disinfection technique.
- Adapt the current technology to disinfect flat areas and featured geometries rather than the cavity of a tooth.
- Disinfect samples covered in bacteria associated with causing surgical site infection, Staphylococcus Aureus and Staphylococcus Epidermis.
- Experiment on materials utilised in surgical procedures and implants, Stainless Steel 316L and Perspex.

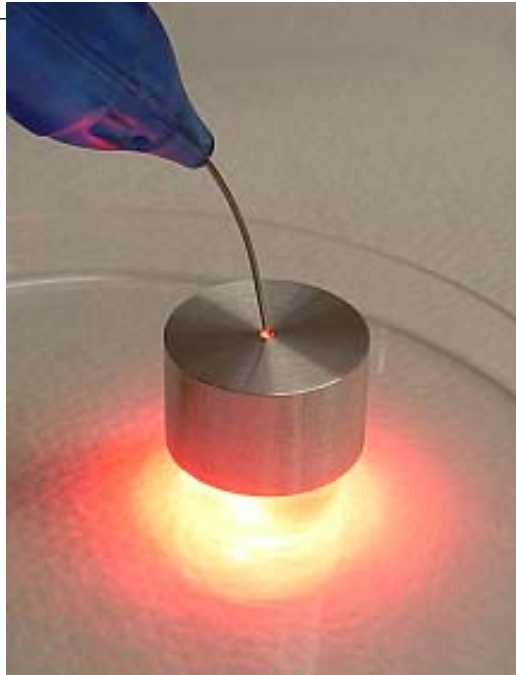


Figure 1 – photo activated disinfection using caries tip and reflector on Perspex sample

Project Outcomes

Trials were carried out on plane samples of perspex and medical grade stainless steel which had been contaminated with one or other of the two bacteria types used, *S. Aureus* and *S. Epidermis*. Trials were also carried out on samples with geometrical features such as slots to represent typical surface features that are likely to be encountered on real devices requiring sterilisation. The laser caries tip was adapted using a specially designed reflector head (Fig. 1). Typical kill rates were >99.98% when the light energy output was optimised.

Conclusion

The project examined whether photo activated disinfection could be used as a disinfection process outside of the dental field. Results were very encouraging showing excellent kill rates on bacteria found in medical and surgical situations. Medical grade stainless steel and perspex can be disinfected very effectively using photo activated disinfection. The outcomes from this project show the feasibility and potential for continuing research into the development of photo activated disinfection for use on medical devices and implants.