**Photodynamic therapy using**

**Gallium and Curcumin on *Streptococcus mutans* NCTC10449**

S P Valappil\*a), W Paul b), C Brown a), C K Hope a), S M Higham a), C P Sharmab).

S.Valappil@liverpool.ac.uk

a) Department of Health Services Research and School of Dentistry, University of Liverpool, Liverpool, United Kingdom; b) Central Analytical Facility, Biomedical Technology Wing, Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum, India

Photodynamic therapy (PDT) with anti caries agents; curcumin, gallium and curcumin complexed gallium (Cur-c-Gal) was explored on *S. mutans* NCTC10449.

Antibacterial assay as per the CLSI performance standard was conducted on Mueller-Hinton agar with 5% sheep’s blood which were inoculated with standardised cultures of *S. mutans* NCTC10449, and incubated for 48h aerobically at 37°C. The diameters of zones of inhibition around test samples and controls (Erythromycin; 15µg) were measured in triplicate. Minimum inhibitory concentration (MIC) of the materials were analysed using broth dilution assay. PDT assay, based on colony-forming-unit (CFU), was conducted on planktonic suspension of *S. mutans* treated with curcumin, gallium or Cur-c-Gal at concentrations from 0-40µg/ml. Light irradiation with a center wavelength of 450nm was applied using an LED (power density of 100mW for 5min at an energy density of 12.3W.cm-2). Log10(CFU/ml) values were analyzed using one-way ANOVA followed by the Tukey test (p<0.05) using the SPSS software (New York, USA).

Antibacterial assay established zones of inhibition of *S. mutans* to be 18.3 ± 0.3 mm for Cur-c-Gal, compared with erythromycin (45± 1.0 mm), gallium (29.3 ± 1.3 mm) and curcumin (11.0 ± 0.0 mm). MIC values were established and PDT analyses suggested that the antibacterial effect to be significant (p<0.05); 86.72% reduction in CFU compared with a 64.33% reduction in the absence of PDT. Gallium demonstrated a significant reduction in colony formation, with 12µg/ml concentration; showing 100% reduction in CFU both in the presence and absence of PDT (p<0.05).

Curcumin, gallium and Cur-c-Gal displayed growth inhibition of *S. mutans* compared with controls and the antibacterial activity was enhanced in the presence of photosensitizers. This suggest the potential use of this technology in caries treatment.

This work was supported by UKIERI (IND/2012-13/EDU-UKIERI/118).

25 word summary

Photodynamic therapy enhanced growth inhibition of *S. mutans* NCTC10449 in the presence of photosensitizers curcumin, gallium and curcumin complexed gallium.