INTRODUCTION
Cancer gene therapy for head and neck squamous cell carcinoma (HNSCC) has been limited by difficulties delivering and monitoring expression of the therapeutic gene in vivo. By utilising a nanoparticle vector complexed with the sodium iodide symporter (responsible for the thyroid gland’s ability to concentrate iodide) we demonstrate an agent which can be used to both monitor and treat HNSCC and its metastases.

METHODS
• Polypropyleneimine dendrimers (DAB-16) were complexed with a plasmid encoding the sodium iodide symporter (NIS).
• The complex was injected intra-tumorally (IT) or intravenously (IV) into both nude and immune competent mice bearing 1 or more subcutaneous HNSCC.
• 99mTechnicium was injected intraperitoneally and whole-body SPECT-CT imaging of the mice was performed.
• Quantitative real time polymerase chain reaction (qRT-PCR) of biopsied tumour samples and other organs was used to confirm areas of gene expression.
• Negative controls of naked DNA and dendrimer alone were used.

RESULTS
• Whole-body imaging of NIS expression in the live animal using SPECT-CT demonstrated that cancer-selective gene transfer was achieved upon systemic administration of the nanoparticles.
• Only the tumours showed a positive results on both scanning and qPCR.
• There was no detectable hNIS DNA by qPCR nor uptake of 99Tc in any other region of the mouse than the tumour or areas of endogenously expressed mouse NIS (e.g. thyroid, stomach, salivary glands).
• The formulation is cancer selective and specific.

DISCUSSION
• This is the first time cancer specific gene transfer has been reproducibly achieved using a systemically administered agent.
• The use of hNIS gene allows a therapeutic approach in the form of radio-iodide as well as a way of non-invasively monitoring gene therapy in real time.
• By using a model with 2 independent tumours we show the potential use in treating metastatic disease.

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