

Revolutionary biodegradable pellet targets glue ear infection

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A revolutionary biodegradable pellet which slowly releases antibiotics into the middle ear could transform the lives of thousands of children who suffer from glue ear.

Scientists at The University of Nottingham have developed the tiny controlled-release antibiotic pellet which can be implanted in the [middle ear](#) during surgery to fit grommets, or small ventilation tubes. Over a period of three weeks it will release effective quantities of antibiotics to target any infection which can, in up to 20 per cent of cases, result in [children](#) having to return for a second and sometimes a third operation.

The team has been led by John Birchall, Professor of Otorhinolaryngology, and Roger Bayston, Associate Professor of Surgical Infection, in the Faculty of Medicine and Health Sciences. Professor Birchall said: “Glue ear is one of the commonest complaints that we see in children in the ENT clinic. The condition causes hearing loss, problems with speech or schooling, and often it is accompanied by repeated ear infections. We are particularly concerned about children that have glue ear that comes back despite grommet surgery — with risks of permanent damage to the ear drum or the middle ear. This exciting new research to try to reduce the need for repeated grommet insertion involves ENT surgeons, microbiologists and pharmacists. Having such a multidisciplinary team on board means that we can take advantage of all the expertise available to help these children.”

Up to 80 per cent of children are affected temporarily by glue ear. Glue

ear causes hearing impairment and subsequently can affect speech and schooling. Glue ear can also be associated with frequent ear infections. As many as 33,000 grommets are fitted in England and Wales every year. In Nottingham alone 300 to 400 children are referred to a specialist — 100 of them will require grommets. Whilst treatment with grommets is effective, the grommets are designed to extrude after about nine months or so. Unfortunately glue ear can return and one in five children will have to have surgery again.

Glue ear happens when a thick mucus collects inside the ear, at the other side of the ear drum. This interferes with hearing and therefore with schooling, social development and relationships with friends and siblings. Following research by this group and others, it is now recognised that glue ear is caused by biofilms — bacteria which grow together in a protective ‘slime’. They are very difficult to treat because they are capable of turning off target sites for common antibiotics, becoming up to 1,000 times less susceptible. In a significant proportion of cases, antibiotics have only a temporary effect and repeated grommet operations are needed.

First, the team produced a biodegradable pellet capable of doing the job. Dr Mat Daniel said: “We tested antibiotics against biofilms in the laboratory but it rapidly became apparent that very much higher levels of antibiotics would be needed. Because of that we knew that giving antibiotics by mouth was not going to work. We developed this biodegradable antibiotic pellet so we could put it directly into the ear — where the actual infection is. We hope that in the future this may very much reduce the need for any children to have more than one operation.”

Next, they found a way of demolishing the biofilm to make the infection easier to treat. This work has been the responsibility of Dr Saif Al-Zahid. He said: “Bacteria in biofilms are held together in a strong matrix.

We have recently found that the expectorant N-Acetylcysteine is able to break down this biofilm matrix effectively — thereby releasing bacteria to a free-floating planktonic form. In doing so [antibiotics](#) become much more effective in killing bacteria as the protective properties of a biofilm are no longer present. N-Acetylcysteine has an added benefit due to its mucus reducing properties — this is desirable in glue ear as the middle ear is filled with a thick mucus secretion. As a result the addition of N-Acetylcysteine in our antibiotic pellet would be likely to increase the chance of eradicating middle ear biofilms and speed up the resolution of glue ear.”

Provided by University of Nottingham

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