QS1 Every deaf child should be considered as a potential candidate for provision with a personal radio aid as part of their amplification package, at first hearing aid fitting. (See also QS10.)

The very early fitting of personal hearing aids following the introduction of the Newborn Hearing Screening Programme has seen hearing aids being fitted as early as four weeks of age.

Infants have considerable prenatal experience of their mother's speech patterns (Lecaunet & Granierre-Deferre, 1993). This is thought to prime the auditory system allowing very young children to acquire a substantial amount of information about the structural organisation of their native language in a relatively short period of time (Jusczyk, 1997). It has also been demonstrated that normally hearing children as young as one month old can discriminate simple voicing contrasts (Eimas, et al 1971). It follows that even early identified deaf children receiving hearing aids at four weeks are already at a significant disadvantage in respect of auditory experience.

Noise, whether it is from a TV, a car, or from traffic noise walking along a road, conversational chatter in cafes or exuberant children in mother and toddler groups, has a detrimental impact on hearing children (Ross, 1992). More recently Bradley and Sato (2008) clearly demonstrated Grade 1 children with normal hearing need a signal to noise ratio of greater than +15 dB to achieve adequate speech intelligibility scores.

Hearing aids work optimally in quiet at a distance of up to 1.5 metres but are less useful at distance or in noisy settings. It follows then that the early identified deaf child receiving hearing aids at four weeks, already at a significant disadvantage in respect of auditory experience, is further disadvantaged.

Ahktar (2001, 2005) demonstrated that 2 year old hearing children make significant use of overhearing to learn vocabulary, adding to that learnt in direct conversations. Floor and Aktar (2006) showed that 18 month old infants can learn words through overhearing. This is a significant way for hearing children to learn language and once again demonstrates the disadvantage of deaf babies in respect of auditory experience.

The idea of a radio aid at first hearing aid fitting is to make use of what is known about very early language development, room acoustics and auditory perception as well as the potential benefits and limitations of personal amplification.

Frequently Asked Questions

1. How do parents know when to use the system?

   With sensitive individualised advice parents/carers will start to identify poor listening environments e.g. baby seat facing backwards in a car, forward facing pushchair, in a café, and will make use of the technology in such situations.

2. Can parents manage the technology?

   Several studies have shown that parents are keen to exploit possibilities such systems offer and, with support, become very capable users.

3. Who is going to fit it?

   This is an opportunity for Health and Education to build on the foundations of NHSP through collaborative working as radio aid/streamer technology is best fitted and managed jointly.

4. What about babies overhearing conversations when the microphone is not muted?

The challenge of forgetting to mute is not the same as at school. At home parents are nearby and may be talking to a family member, a friend or on the phone. The deaf child will overhear just as hearing children do. Mullah (2007) described parental reports of overheard conversations being repeated by their deaf child "Suppose I have an idea" and "Absolutely not". Rather than seeing this as a problem evidence suggests that at home, it may be an advantage. This suggests that the crucial nature of needing to mute in a classroom situation is not replicated in the home environment.

Research continues to demonstrate that very early identification of permanent childhood deafness does not yet allow age appropriate language scores in the majority of cases. In a study of 12 early identified deaf children compared to normally hearing children, Moeller et al, (2007a, 2007b) considered early vocalisations and early word use in deaf children. Despite early identification and hearing aid fitting the deaf children lagged behind in consonant and syllable structure. This is thought to be related to the impact of the loss of high frequency information and the negative impact of distance, noise and reverberation in everyday settings. This is the challenge that well used radio amplification can help to meet.

Radio amplification (this may be a streamer) should be available at first hearing aid fitting to ensure that deaf children have the opportunity to take advantage of the early listening and language opportunities that typify the first year of life, and to hear in a noisy world.

Early Years research poster:

The use of FM systems in pre-school children: management issues and practical considerations

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Introduction

Typical current practice within the UK is to provide FM systems via specialised educational services for use in an educational environment. A body-worn transmitter and receiver are introduced at nursery or school when more formal group sessions require an improved signal to noise ratio.

Publications from the US (Moeller et al 1996) have extended the use and shown the benefits of using FM systems in non educational settings for children from the age of one. With the advent of the Newborn Hearing Screening Programme in the UK it is possible and desirable to begin FM use in suitable environments soon after hearing aid use has been established.

Methods

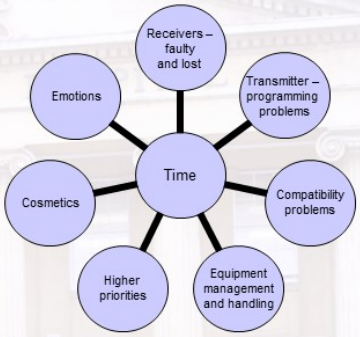
Five children aged one to three with moderate to profound bilateral sensorineural hearing loss and their parents trialled a small commercial wireless FM system with ear level receiver and body worn transmitter. The table identifies relevant information about each subject:

Subject	Age	Degree of hearing loss	Age hearing aids provided	Age hearing aid use established	Setting FM system used
JC	3 years 11 months	Profound	2 months	12 months	Home and nursery
OS	2 years 2 months	Profound	2 months	2 months	Home
OC	3 years 1 month	Moderate	3 months	3 months	Nursery
PG	3 years 7 months	Moderate	4 months	18 months	Nursery
AB	1 year	Profound	1 month	1 month	Home and nursery

Each family was given an FM system and information pack designed to be self explanatory by their Teacher of the Hearing Impaired (ToHI). All ToHIs were experienced in fitting FM systems to older children. The packs contained:

- Easylink transmitter with handbook
- 2 MicroMLxS receivers
- 2 audio shoes
- NDCS booklet – An introductory guide to radio aids
- PEACH questionnaire
- FM listening evaluation for children questionnaire

Management issues and practical considerations



Areas highlighted

All of the families felt that their children would benefit from being able to hear speech more clearly in background noise, as they identified in the PEACH questionnaire. Three out of the five families felt the FM system was beneficial in certain situations, increasing the child's involvement in activities. Nursery staff reported that they were more active participants within the group. Two families eventually decided to defer participating in the study as they were beginning the process of cochlear implant assessment and wished to focus on this.

Equipment management was expected to be the largest problem but was found to be minor compared to emotional issues raised. Initial difficulties with functioning, compatibility and maintenance of the equipment compounded the emotional reaction from both parents and children and meant that fitting took significantly longer than expected. The strength and variety of emotional reactions to the new equipment had not been anticipated. Rejection of body worn FM systems has been documented (Benoit 1989) but because of the discreet nature of the equipment used this was not expected. In this small study it was found that the family's initial reaction to diagnosis and hearing aid use was a predictor for success with the FM system.

The project placed significantly more pressure on teacher time than anticipated resulting in play and language sessions being usurped frustrating both teachers and families.

Next steps

The positive responses from the families and nurseries of three out of five of the children who took part in this pilot study and research on the benefits early introduction of FM justify expanding the project. Our findings suggest that the emotional impact of introducing FM early has to be carefully managed if it is not to jeopardise the scheme. Therefore, in the next phase, to foster confidence in all participants, we plan to pilot joint fitting sessions with parents, ToHI, educational audiologist and audiologist in addition to follow up by ToHI and a central contact for parents and ToHIs to address concerns.

Berkshire Sensory Consortium Service

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Moeller M.P., Donaghy K.F., Beauchaine K.L., Lewis D.E. and Stelmachowicz P.G. 1996. Longitudinal study of FM system use in nonacademic settings: effects on language development. *Ear and Hearing*, 17:28-41
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Benoit R. 1989. Home use of FM amplification systems during the early childhood years. *Hearing Instruments*, 40:8-12

Royal Berkshire NHS Foundation Trust

FM UK UK Children's FM Working Group **QS 1**

Other references: Bradley J.S. and Sato H. (2008) The intelligibility of speech in elementary school classrooms

BATOD Association Magazine 2013

H Cooper and C Statham **FM for babies and toddlers** (p10)
Can such young children gain a real benefit from being fitted with FM systems? Hannah Cooper, a senior Clinical Scientist in paediatric audiology at the Royal Berkshire NHS Foundation Trust, and Cate Statham, an educational audiologist with the Berkshire Sensory Consortium Service, set out to find out whether families really felt that they could be of benefit. With the help of ten integrated systems provided by Phonak, the study looked at children between the ages of two months and three years and followed their progress to see what difference the systems made to their lives.
http://www.batod.org.uk/index.php?id=/resources/audiology/fmsystems/fm-for-babies.htm

I Mulla **Technology for Pre-School Children** (p12)
The use of hearing technologies can be used to help the early identification of hearing loss through the newborn hearing screening programme. Imran Mulla, the Ear Foundation's Research Co-ordinator, talks about his conference workshop which looked into four aspects of this subject: signal to noise ratio, an overview of FM/wireless technologies, pre-school use of FM technology and Language Environment analysis (LENA).
http://www.batod.org.uk/content/resources/audiology/fmsystems/Making-the-most-of-Technologies-with-Pre-School-Children.pdf

See also BATOD Conference 2017 ppt

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