

National Horizon Scanning Centre

SpeechEasy Wireless Altered- Auditory Feedback (AAF) device for stammer

September 2007



This technology summary is based on information available at the time of research and a limited literature search. It is not intended to be a definitive statement on the safety, efficacy or effectiveness of the health technology covered and should not be used for commercial purposes.

SpeechEasy Wireless Altered-Auditory Feedback (AAF) device for stammer

Target group

- Stammer – speech aid in children, adolescents and adults.

Technology description

SpeechEasy is a prosthetic device that simulates the ‘choral effect’ to aid the speech of people with a stammer. The ‘choral effect’ describes the phenomenon that a stammer is usually clearer when an individual is singing or speaking in unison with other people. The technology works by electronically generating a digitally altered auditory feedback (AAF) sound, which is either slightly delayed in time (delayed auditory feedback: DAF), or at an altered frequency (frequency auditory feedback: FAF), or a combination of both. The device does not use a third type of AAF, masked auditory feedback (MAF).

SpeechEasy is a thumbnail-sized, wireless device, that is digitally programmable with specialised computer software, providing a range of settings of DAF and FAF that enable the device to be tailored to each user. The SpeechEasy device is available in three models: a type that fits behind the ear, a model that sits mainly in the inner-ear canal, and a model that sits completely in the ear canal. The technology is designed to either be an adjunct to current stuttering therapy such as speech and language therapy.

Innovation and/or advantages

SpeechEasy is a wireless version of available AAF devices.

Developer

Janus Development Group (US) and SpeechEasy International (developer for all other countries), EU distributor: MedSys.

Place of use

- | | | |
|---|--|---|
| <input checked="" type="checkbox"/> Home care | <input checked="" type="checkbox"/> Community or residential care
e.g. speech therapist | <input type="checkbox"/> Primary care e.g. used by GPs or
practice nurses |
| <input type="checkbox"/> Secondary care e.g. general, non-
specialist hospital | <input type="checkbox"/> Tertiary care e.g. highly specialist
services or hospital | <input type="checkbox"/> Emergency care e.g. paramedic
services, trauma care |
| <input type="checkbox"/> General public e.g. over the
counter | <input type="checkbox"/> Other: | |

Availability, launch or marketing dates, and licensing plans:

The SpeechEasy device is CE marked. Until recently, patients from the UK had to travel to the USA to be fitted with the device.

NHS or Government priority area:

- | | | |
|---|--|--|
| <input type="checkbox"/> Cancer | <input type="checkbox"/> Cardiovascular disease | <input type="checkbox"/> Children |
| <input type="checkbox"/> Diabetes | <input type="checkbox"/> Long term neurological conditions | <input type="checkbox"/> Mental health |
| <input type="checkbox"/> Older people | <input type="checkbox"/> Public health | <input type="checkbox"/> Renal disease |
| <input type="checkbox"/> Women's health | <input type="checkbox"/> None identified | <input checked="" type="checkbox"/> Other: |

Relevant guidance

- Department for Education & Employment. Provision for children with speech and language needs in England and Wales: Facilitating communication between education and health services. Research Brief No.239. November 2000¹.

Clinical need and burden of disease

It is estimated that 1% of adults have a stammer (approximately 408,000 adults in England and Wales), with the severity and exact features varying between individuals².

Most stammering starts in early childhood during the development of speaking skills, and is referred to as developmental stammering. It is much less common for stammering to start in adult life, when it is known as acquired stammering or late-onset stammering. It is estimated that 5% (154,000) of pre-school children go through a phase of stammering during their speech and language development and that 1.2% (96,000) of school-age children stammer². Stammering is more common in males than females.

Existing comparators and treatments

- Speech and language therapy:
 - Stammering modification approaches – e.g. block modification and avoidance reduction therapy
 - Fluency modification techniques e.g. slowed/prolonged speech with the aim to replace stammered speech with fluent speech
 - Vocal fold management
 - Psychological approaches e.g. counselling, cognitive therapy, relaxation techniques
- Alternative approaches:
 - Anxiety control management
 - Assertiveness and social skills training
 - Brief therapy (solution focused therapy)
 - Hypnosis
 - Narrative therapy
 - Neuro-linguistic programming
 - Process orientated psychological approach
- Electronic devices - There are a number of other electronic aids that also use AAF, but without wireless technology:

Company & Product	AAF features	Features	Availability & Cost (estimated)
Janus Development Group: SpeechEasy	<u>DAF</u> : Up to 220ms, programmed, but not user adjustable <u>FAF</u> : 500, 1000 or 2000 Hz <u>MAF</u> : No	3 types: behind the ear, in the ear canal, completely in the ear canal. Wireless device. Digital signal processing. Digitally programmable, to tailor the device to each user. Noise reduction features: (e.g. high frequency filter).	MedSys -UK distributor. Cost (US): \$4100-\$4900.
Casa Futura Technologies: Pocket speech lab	<u>DAF</u> : 30-200ms, user adjustable <u>FAF</u> : +0.4 to -1.2 octaves in 0.2 octave steps <u>MAF</u> : Manual control button	Headphones linked by wires to a portable (pocket-sized) signal process and microphone device (11.5x7x2cm, 145g). Analyses voice frequency and amplitudes to determine whether vocal folds are tense or relaxed. Highlighted (i) Red or green lights (ii) DAF/ FAF switches on when tense (iii) Digital clock calculates percentage of speech	For UK patients: They can either order the device directly from Casa Futura, or arrange for a speech clinic to organise this. Price is the same,

		that is tense. Plugs into telephones (i.e. phone use). Binaural or monoaural.	plus p&p. Cost: \$3495
Casa Futura Technologies: SmallTalk	<u>DAF</u> : 30-200ms, user adjustable <u>FAF</u> : +0.4 to -1.2 octaves in 0.2 octave steps <u>MAF</u> : No	Headphones linked by wires to a portable (pocket-sized) signal process and microphone device. Noise reduction features for use in noisy environments. Plugs into telephones (i.e. phone use). Binaural or monoaural.	As above. Cost: \$2495
Casa Futura Technologies: Telephone fluency system	<u>DAF</u> : 50ms fixed <u>FAF</u> : +0 to -1.2 octaves in 0.2 octave steps <u>MAF</u> : No	Plugs into telephones so user hears own and callers voice in both ears. Caller hears user's normal voice. Background noise reduction features. Binaural or monoaural.	As above. Cost: \$1495
Casa Futura Technologies: School DAF	<u>DAF</u> : 30-200ms, user adjustable <u>FAF</u> : No <u>MAF</u> : No	Device is for treating children who stutter. Noise reduction features (e.g. noise cancelling directional microphone; high frequency filters; Dynamic expansion) Binaural or monoaural	As above. Cost: \$995
VoiceAmp (South African-based): VoiceAmp 601	<u>DAF</u> : 30-200ms, user adjustable <u>FAF</u> : +0.4 to -1.2 octaves in 0.2 octave steps <u>MAF</u> : no	Looks like an MP3 player - Users can fine tune the setting (either using a computer or by controls on the device) Noise reduction features. Binaural or monoaural.	Requires expert calibration and adjustment, and ongoing therapy and support. \$1850
A.S. Genstar Limited: Defstut	<u>DAF</u> : yes <u>FAF</u> : no <u>MAF</u> : yes	Headset, microphone and device (connected by wires) Plans to use bluetooth technology for wireless connection	Test sessions held in UK (2004) UK distributor. Cost: \$350
Digital Recordings Inc. (Canada): Digital speech aid III & Digital speech aid V	<u>DAF</u> , <u>FAF</u> and <u>MAF</u>	Picks up voice and digitally alters sound. Used with headphones	Unsure.
Kay Elemetrics: Facilitator model 3500	<u>DAF</u> and <u>MAF</u>	Designed for therapist/ clinic and self-client use. Auditory feedback types (amplification, looping, metronomic pacing)	UK Distributor: (Wessex Technology Group)

Efficacy and safety

A non-systematic review³ of peer-reviewed journal papers published from 1995-2005 that investigated the effect of AAF concluded that there is some experimental and limited phase I evidence of benefit, but that knowledge about the effect of AAF during conversational speech and everyday situations is missing. There is evidence that AAF impacts positively on reading aloud (40-85% reduction in stuttering). There is only limited evidence of efficacy, and debate about possible risks to normal speech development of AAF in children.

Trial name	SpeechEasy AAF in laboratory conditions	SpeechEasy AAF: Initial fitting, 4 month and 1-year follow-up
Sponsor	Micro-DSP	Janus Development Group
Status	Published ⁴	Published ^{5,6}
Location	Single site (US)	Single-site (US)
Design	Non-randomised, non-blinded	Non-randomised, non-blinded
Participants in trial	n=13, adults aged 21 to 45 years (mean=35.3 years). Oral reading, monologue and conversation <u>Pre-device</u> : No device - baseline <u>Device-only</u> : SpeechEasy only	Adults (22 to 55 years old) and youths (9 to 18 years old) with a stammer. <u>Initial fitting, 4-month and 1-year follow-up</u> : (n=9) Monologue and reading - the effect of time (initial fitting versus 4-months), group (youth versus adult), speech task (reading versus

	<u>Device-plus</u> : SpeechEasy and instructions for speech technique <u>Post-device</u> : No device	monologue), and device (present versus absent) on stuttering rate was examined. Naïve listeners rated speech naturalness. <u>Initial fitting</u> : (n=7) Proportion of stuttering during oral reading and monologue. <u>1-year</u> : (n=9) Self-report inventory on struggle, avoidance and expectancy.
Follow-up	None	4 months, 1 year
Outcomes	Stuttering rates; factors influencing stuttering rates.	Stuttering rates; factors influencing stuttering rates; naturalness of speech; perception of struggle and avoidance.
Key results	Compared to pre-device conditions, device-only reduced stuttering by 42%, 30% and 36%, and for device-plus by 74%, 36% and 49% for reading, monologue and conversation respectively. Mean stuttering frequencies (% syllables stuttered): <u>Reading</u> : pre-device=20.9; device-only=12.1; device-plus=5.4; post-device=13.4. <u>Monologue</u> : pre-device=18.2; device-only=12.8; device-plus=11.6; post-device=15.3. <u>Conversation</u> : pre-device=16.8; device-only=10.8; device-plus=8.5; post-device=12.0. Two-way repeated-measures analysis of variance found highly significant differences between participant ($F_{2,124}=32.4$; $p<0.001$), speech task ($F_{2,124}=6.6$; $p<0.002$), and condition ($F_{3,124}=25.54$; $p<0.001$).	<u>Initial fitting, 4-months and 1-year follow-up</u> : Data was not reported for 1 participant at 4 months, and for a different participant at 1-year. Stuttering rate was significantly reduced with device regardless of speech task or group, and effect remained at 4 months ($p=0.0028$). Speech with the device was significantly more natural than without the device for both reading and monologue at baseline and follow-up ($p<0.0001$). Speech naturalness with the device was significantly greater at 1-year than at initial and 4-month testing ($p<0.0001$ for reading and monologue). Speech naturalness without the device was significantly more natural at 1-year than at initial testing for reading ($p<0.002$), but not for monologue ($p<0.18$). <u>Initial fitting</u> : Stuttering was significantly reduced by approximately 90% during reading and 67% during monologue ($p=0.011$). <u>1-year follow-up</u> : (n=8) Self-reported perceptions of struggle avoidance and expectancy were significantly reduced ($p<0.05$) relative to pre-fitting.

Estimated cost and cost impact

The cost of the device ranges from \$4,100 (£2,050) for the behind-the-ear model, to \$4,900 (£2,450) for the completely-in-the-ear-canal model^a. Part of the cost of the device includes the fitting of the device and the development of a mould specifically designed for each person and ongoing device adjustments. Variable amounts of initial and ongoing speech and language therapy are also necessary.

Potential or intended impact – speculative

Patients

- Reduced morbidity
- Reduced mortality or increased survival
- Improved quality of life for patients and/or carers
- Quicker, earlier or more accurate diagnosis or identification of disease
- Other:
- Non identified

^a Exchange rate based on \$1 to £0.50.

Services

- | | | |
|--|--|--|
| <input type="checkbox"/> Increased use | <input type="checkbox"/> Service reorganisation required | <input checked="" type="checkbox"/> Staff or training required |
| <input type="checkbox"/> Decreased use | <input checked="" type="checkbox"/> Other: Long-term use of the SpeechEasy device may result in decreased need for other speech therapy services | <input type="checkbox"/> Non identified |

Costs

- | | | |
|--|--|---|
| <input type="checkbox"/> Increased unit cost compared to alternative | <input type="checkbox"/> Increased costs: more patients coming for treatment | <input type="checkbox"/> Increased costs: capital investment needed |
| <input checked="" type="checkbox"/> New costs: SpeechEasy device and fitting | <input checked="" type="checkbox"/> Savings: Possible long-term reduction in need for speech therapy | <input type="checkbox"/> Other: |

References

- ¹ Law J, Lindsay N, Peacey N *et al.* Provision for children with speech and language needs in England and Wales: Facilitating communication between education and health services. Department for Education and Employment, Research Brief No.239. November 2000.
- ² British Stammering Association. General information on stammering. <http://www.stammering.org/generalinfo.html> [accessed 8th August 2007].
- ³ Lincoln M, Packman A, Onslow M. Altered auditory feedback and the treatment of stuttering: A review. *Journal of Fluency Disorders*, 2006; 31:71-89.
- ⁴ Armson J, Kiefte M, Mason J *et al.* The effect of SpeechEasy on stuttering frequency in laboratory conditions. *Journal of Fluency Disorders*, 2006; 31:137-152.
- ⁵ Stuart A, Kalinowski J, Rastatter MP *et al.* Investigations of the impact of altered auditory feedback in-the-ear devices on the speech of people who stutter: Initial fitting and 4-month follow-up. *International Journal of Language Communication Disorders*, 2004; 39(1):93-113.
- ⁶ Stuart A, Kalinowski J, Saltuklaroglu *et al.* Investigations of the impact of altered auditory feedback in-the-ear devices on the speech of people who stutter: One-year follow-up. *Disability and Rehabilitation*, 2006; 1-9.

The National Institute for Health Research National Horizon Scanning Centre Research Programme is funded by the Department of Health.

The views expressed in this publication are those of the author and not necessarily those of the NHS, the NIHR or the Department of Health

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