AUDIOMETRIC FINDINGS IN CALL CENTRE WORKERS EXPOSED TO ACOUSTIC SHOCK

B W Lawton ISVR Consulting, University of Southampton

1 INTRODUCTION

More and more people in the United Kingdom are using the telephone to interact with suppliers of goods and services. This growth of call centre usage has required an increase in the number of call centre workers; an estimated 2% of the UK working population is now employed in call centres [1]. This relatively new occupation has found itself subject to a long-recognised occupational hazard: acoustic shock.

Acoustic shock is broadly defined as a sudden and unexpected burst of noise transmitted through the call handler's headset; this noise is usually high frequency. The signal may be caused by interference on the telephone line, by mis-directed faxes, or by a smoke or fire alarm sounding at the caller's end. There have been instances of malicious callers blowing whistles into the sending handset.

The level of such unexpected acoustic events may be subjectively high, much greater than the call handler's desired speech listening level. However, the earphone output level may have been limited by fast-acting compression circuitry in the call-handling equipment, or as a last resort by peak-clipping in the earphone itself. For headsets as worn by call centre workers, the maximum output sound pressure level is limited to 118 decibels re 20 μPa or to 118 dB(A) [2,3,4]. In response to such unexpected loud sounds, the natural reaction is to remove the headset quickly, thus limiting the exposure duration to a few seconds. The call handler may be shocked or startled by the piercing noise, but exposure to these acoustic events is not sufficient to cause hearing loss as assessed by conventional methods. However, other auditory and neurological symptoms may develop, resulting in a personal injury claim against the call handler's employer.

This paper presents summaries of the symptoms of eighteen UK call centre workers making compensation claims. The findings are taken from the reports by claimants' and defendants' medical examiners.

2 THE REPORTED SYMPTOMS

Call centre workers making personal injury claims report three types of symptoms, usually in combination.

1. It may be alleged that the acoustic incident has caused a hearing loss, or has initiated tinnitus (ringing) in the affected ear, or that the incident has produced some transient balance disorder. Such conditions imply a degree of insult or damage to the inner ear.

2. Claimants may also describe a sense of fullness / blockage of the ear, recurrent pain in the ear, or sensations of numbness or burning felt in the head, neck, shoulder and down the arm on the affected side.

3. Claimants may report reactions and emotional responses stemming from the acoustic shock incident(s). Unusual sensitivity to everyday sounds is not uncommon; this hyperacusis can lead to fear of loud sounds, and associated anxiety and panic in some acoustic environments. Serious depression has also been linked to acoustic shock incidents.

Because the compensation claim is related to an acoustic incident and involves some aspect of hearing, an ear nose and throat consultant is commissioned to perform a medical examination and report to the Court. The results of 18 such examinations have been summarised here from the medical reports.

The reported medical findings for the 16 female and 2 male claimants are given in Table 1. Most of the call handlers were using a monaural headset when exposed to the acoustic shock signals; some individuals reported experiencing several shocks spread over a few months.

2.1 Hearing loss

The audiograms show that some subjects had high-frequency losses, which the ENT specialists took to indicate noise-induced hearing loss. However, headphone output is limited so that the equivalent unobstructed field level ranges between 105 dB(A) and 111 dB(A) for wideband noises and tonal signals, respectively. Such levels are high, and understandably startling if sudden: the subjects reported removing the headset after a few seconds of the acoustic shock signal. It is highly unlikely that an exposure lasting 5 to 15 seconds would produce any lasting shift of the hearing threshold.

Fourteen of the eighteen claimants alleged hearing loss as a result of the acoustic shock incidents. Most of these claims showed age-associated hearing loss, equal and bilateral losses despite one-sided acoustic shock(s), and exaggerated losses (termed non-organic by the medical examiners).

2.2 Tinnitus

Subjective tinnitus is a sensation of sound which does not have an identifiable physiological or acoustical origin; it may be perceived in one ear, both ears or in the head. Most people have experienced tonal or noise-like tinnitus at some time, often as an after-effect of loud noise. The symptom can occur on a variety of time scales, ranging from a few seconds, all the way to continuously audible.

Of the eighteen call centre workers considered here, eleven reported that their tinnitus was first heard immediately after the acoustic shock incident(s): the cause-and-effect relationship is inescapable. Two others had pre-existing tinnitus.

When the claimant presents for medical examination, the hearing specialist can only record the history and description of the tinnitus. Unfortunately, there are no diagnostic tests which indicate severity of the tinnitus, or even its existence. The medical examiner

must, however, judge the tinnitus severity on a simple scale such as that put forward by McCombe *et al* [5]:

slight:	experiencing tinnitus but not troubled by it heard only in quiet environment very easily masked no interference with sleep or daily activities
mild:	masked by environmental sounds easily forgotten during activities may sometimes interfere with sleep but not daily activities
moderate:	may be noticed even in background or environmental noise daily activities may still be performed less noticeable when concentrating sometimes interferes with sleep and quiet activities
severe:	almost always “heard”, rarely (if ever) masked disturbs sleep patterns can interfere with ability to carry out normal daily activities quiet activities affected adversely complaint recorded by GP or other medic hearing loss likely (but not essential)
catastrophic:	all tinnitus symptoms severe documented evidence of medical consultation hearing loss likely (but not essential) associated psychological problems recorded in medical notes

The severity grading depends entirely upon the claimant’s description of his or her psychological reaction to the tinnitus sensation. The medical examiner must balance the consistency of the history against the possibility of compensation-driven exaggeration.

Of the claimants reporting tinnitus, most were judged to have a moderate or severe symptom; two were judged to have catastrophic tinnitus.

2.3 Other ear symptoms

Call handlers have reported experiencing earache, muffled hearing and sometimes lightheadedness immediately after an acoustic shock incident. Such symptoms may develop over the following months as recurrent stabbing pains in the ‘shocked’ ear, a sense of fullness in that ear, and sporadic episodes of dizziness. Audiological physicians and ENT surgeons may find it “difficult to manage” the care of patients with such transient and randomly-occurring complaints.

2.4 Head / neck symptoms

A small proportion of call handlers reported unpleasant feelings in the head and neck immediately following an acoustic shock incident. These include numbness, tingling, and a burning sensation around the ‘shocked’ ear; there may also be numbness and tingling in the face, neck, shoulder, and arm on the affected side. These sensations faded in time.

2.5 Psychological reactions

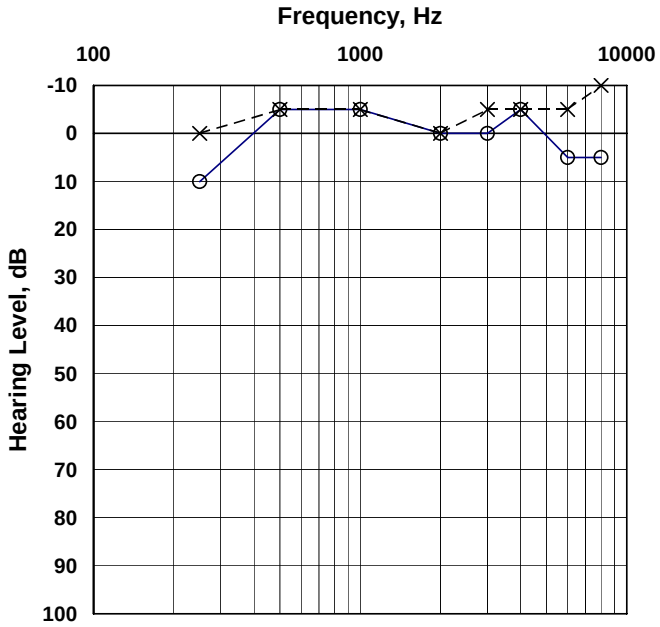
Most shock claimants reported some sort of debilitating reaction or emotional response to the acoustic incident. One common response was hyperacusis, an undue sensitivity to everyday sounds that would not be expected to trouble or distress a 'normal-hearing' individual; this can lead to fear of environmental sounds such as the "ping" from a microwave oven, or the signal from a pedestrian-controlled road crossing. This fear of sound can present problems during the medical examination: one patient became tearful at the prospect of an audiometric earphone being placed on the 'shocked' ear, another became nauseous after tuning fork tests by the medical examiner. Such responses, though extreme, appeared to be genuinely felt by the patients.

Claimants also reported anxiety, stress, panic attacks, headaches and chronic fatigue for many months following the acoustic shock incident(s).

3 THREE CASE STUDIES

The symptoms and findings for three acoustic shock claimants are summarised over the next few pages. The state of hearing at examination is given in each audiogram, plotting hearing level against audiometric frequency; zero on the hearing level scale represents the median for young normal ears, with hearing loss going down the chart. The right and left ear hearing thresholds are given by the circle and cross symbols, respectively.

The first case, number 827, shows quite normal hearing threshold levels despite three acoustic shock incidents. Claimant number 823 alleges hearing loss from two unilateral acoustic shocks; bilateral and equal hearing losses suggest a natural cause. Case number 828 shows a notched audiogram for the 'shocked' ear. The audiometric configuration might be interpreted as a one-sided noise-induced hearing loss, but is more likely to be a confusion between the test tone and the claimant's continuous tinnitus.

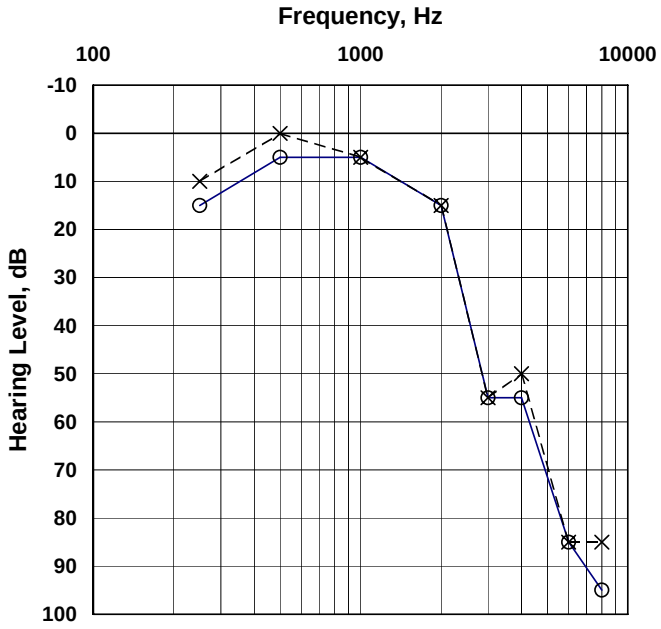


Case number 827, female aged 29 years, three shocks LEFT ear (cross symbol)

Over three month period, experienced three very loud, high pitched sounds from headset earphone worn on left. Immediate pain in ear, removed earphone after a few seconds; disorientation and tinnitus.

Tinnitus now intermittent, lasts several hours, twice a week; does not affect sleep. Intolerance of loud sounds. Occasional sharp stabbing pain in left ear.

No hearing loss, but mild intermittent tinnitus linked in time to acoustic shock incidents.



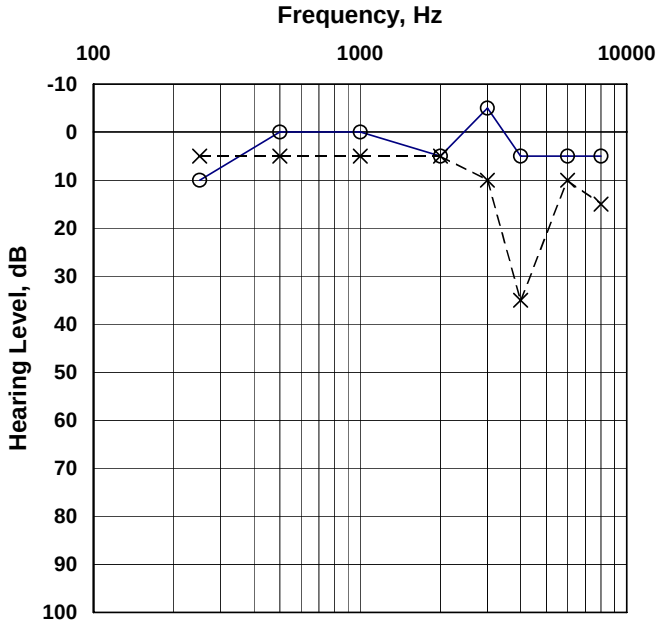
Case number 823, female aged 51 years, two shocks LEFT ear (cross symbol)

Heard very loud, high-pitched sound from headset earphone worn on left; removed headset after a few seconds; immediate pain in ear with muffled / blocked sensation and high-pitched tinnitus; felt disorientated and dizzy; pain and discomfort in neck on left.

Second shock to left ear three months later; exacerbation of ear pain, tinnitus and muffled hearing, pain in neck.

Now experiences speech discrimination loss in crowded, noisy environments; television sound at increased level; sensitive to loud sounds such as alarms. Tinnitus now intermittent, lasting several hours to several days; does not affect sleep; judged to be mild.

Moderate-to-severe high-frequency hearing loss bilaterally; cannot be associated with acoustic shocks to left ear only; bilateral hearing loss due to some natural or constitutional cause. Tinnitus in left ear only, started immediately after incident, therefore associated with acoustic shock.



Case number 828, male aged 41 years, shock LEFT ear (cross symbol)

Experienced very loud sound through single earphone on left; instinctively removed earphone very quickly; immediately felt dazed and nauseous.

Does not complain of hearing loss. High-pitched tonal tinnitus continuously present since incident. Masked by environmental sounds during the day; can be intrusive at night, disturbing sleep; judged to be severe. Apprehensive about wearing headset; anxiety makes his tinnitus worse.

Medicated with anti-depressant drug; has consulted psychiatrist who diagnosed post-traumatic stress syndrome; continues to receive counselling.

On extended sick leave since incident; will not be returning to call centre work requiring the use of a headset.

Hearing deficit in left ear only, at 4 kHz; probable confusion between audiometric tone and tonal tinnitus. Ringing sensation in left ear only, started immediately after incident, therefore associated with acoustic shock.

4 CONCLUSIONS

For the medical examiner, personal injury claims for acoustic shock seem to centre on tinnitus and emotional reactions. There is no consistent hearing loss from the loud but short duration noise exposures. Any resulting tinnitus may be assessed by a hearing specialist, but there is little else for the surgeon or physician to do. Intermittent stabbing pains in the ear, lightheadedness, and numbness in the head-neck-face may start after the shock incident, but these feelings are not associated with neurological deficit. In addition, ENT specialists may have difficulty in assessing the emotional stability and employment prospects of acoustic shock claimants. Stress counselling and psychiatric assessment would seem more appropriate.

The noise engineer or acoustical scientist also has problems when commissioned to report on any particular claim. The shock complained of is in the past, and may be unique and un-repeatable. Any recording made within the call-handling equipment will be subject to automatic gain control, and thus of limited value. As acoustic shocks occur at infrequent and randomly-spaced intervals, it is unlikely that another will occur at the claimant's workstation during a noise survey. In any case, the noise exposure is quite small in noise-at-work terms, and very unlikely to cause any lasting hearing loss as assessed by conventional methods.

Hearing and noise specialists regard assessment of headphone noise exposure and acoustic shock as a measurement headache. Prevention would seem to be the better course.

5 REFERENCES

1. Health & Safety Executive / Local Authorities Enforcement Liaison Committee (HELA). Advice regarding call centre working practices. Local Authority Circular LAC 94/1 (rev) v11. HSE, London (2001).
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3. International Telecommunication Union. Efficiency of devices for preventing the occurrence of excessive acoustic pressure by telephone receivers. ITU-T Recommendation P.360. ITU, Geneva (1998).
4. European Telecommunications Standards Institute. Acoustic safety of terminal equipment (TE): An investigation on standards and approval documents. Technical Report ETSI TR 101 8000 v1.1.1 (2000-07). ETSI, Sophia Antipolis, France (2000).
5. McCombe A *et al*. Guidelines for the grading of tinnitus severity: the results of a working group commissioned by the British Association of Otolaryngologists, Head and Neck Surgeons, 1999. Clinical Otolaryngology 26:388-393 (2001).

Table1: Symptoms reported by call handlers exposed to acoustic shock

subject no., sex, age	acoustic shock ear R or L	hearing and balance					head / neck symptoms	
		hearing loss R or L	tinnitus R or L	earache, recurrent pain	fullness, blockage of ear	lightheaded, unsteady, sporadic dizziness	numbness, tingling, burning around ear	numbness, tingling; face, neck, shoulder, arm
820 F 41 y	R	R feigned	R	R		Yes		R
821 F 44 y	L	R	L	L		Y		
823 F 51 y	L	R + L	L		L	Y	L	L
824 F 55 y	R		R			Y		
825 F 37 y	L		L	L		Y		
826 F 46 y	L		L		L			
827 F 29 y	L		L	L				
828 M 41 y	L	L	L			Y		
4741 F 49 y	unilateral	R+L pre+post	R+L pre+post	Y		Y		
4758n F 38 y	R + L		R + L					
4758h F 60 y	R + L	R + L				Y		
4758*h* M 48 y	R + L	R						
4758c F 33 y	R	R + L		L		Y		
4758w F 27 y	R + L					Y		
4765 F 55 y	R	R + L feigned	R + L	R		Y		R
4801 F 40 y	R	R + L	R pre+post	L			R	
4802 F 39 y	R	R + L					R	R
5173 F 36 y	R	L	R	R	R		R	

continued on next page

Table 1 (concluded): Symptoms reported by call handlers exposed to acoustic shock

subject no., sex, age	reaction, emotional response				
	hyperacusis	fear of sound	anxiety, stress, panic	headaches, fatigue	depression
820 F 41 y	Yes	Y	Y	Y	
821 F 44 y			Y		
823 F 51 y	Y				
824 F 55 y					
825 F 37 y	Y	Y			
826 F 46 y	Y				
827 F 29 y	Y				
828 M 41 y	Y	Y	Y		Y
4741 F 49 y			Y	Y	
4758n F 38 y					
4758h F 60 y				Y	
4758*h* M 48 y			Y		
4758c F 33 y		Y			
4758w F 27 y	Y	Y			
4765 F 55 y			Y	Y	Y pre+post
4801 F 40 y					
4802 F 39 y				Y	
5173 F 36 y				Y	