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# **Microbiological tests on obsolete re-useable Jet Tips for the Propulse ear irrigator: risk of transmitting infection?**

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## **Summary**

The electronic ear irrigator is used daily in general practices throughout the UK. A variety of cleaning methods, dependent on the frequency of use of the irrigator and the local infection control policies are used to clean the now obsolete re-useable Jet Tips.

It has been shown that otitis externa is one of the problems which occur following ear irrigation (Sharp et al. 1990. Grosan, 1998. Roeser and Ballachander, 1997. Browning 2001). External ear canal infections can be related to many factors and as professional clinicians it is our duty of care to address and prevent all possible causes of infection resulting from clinical treatments. One of the possible causes is shown in this study.

There is a significant risk that the obsolete re-useable Jet Tips (obsolete since September 2002), which deliver the water into the patients' ears during irrigation, are not being cleaned effectively and can remain contaminated with bacteria. Disposable 'One Use' Jet Tips are shown to be the preferred and more suitable option.

## **Introduction**

Otitis externa following ear irrigation has been recorded in many studies as shown in the papers mentioned above. There are many factors which can cause this problem and each should be addressed and prevented wherever possible in the duty of care for the patient. Bacteria can rapidly proliferate in a warm moist environment such as the ear canal, especially where the skin has been traumatised or the tissue defences compromised in other ways (Todar, 2004). Hence it is preferable to gently dry the ear meatus following ear irrigation and recognise and treat any potential cause of infection. No cerumen (which has bactericidal properties) remains in the ear canal following the irrigation procedure; consequently the meatal skin is more vulnerable. There is more likely to be evidence of infection occurring where there has been attempted self cleaning (Hooper, 1991) or inflammation caused by the use of some proprietary cerumenolytics (BNF, 2004) prior to irrigation. The patient's general health, skin condition and personal hygiene methods are all relevant factors when considering the probability of otitis externa developing following ear irrigation. It can be difficult to recognise bacterial debris as it can have an appearance of caramel coloured soft cerumen or keratin debris. The inflammation following irrigation may just be attributed to the irrigation process and an infection may develop causing the requirement of another doctor visit and a prescription.

However, another factor to consider is the introduction of bacteria through the use of the irrigator. The cleaning of the irrigator and the technique used when actually irrigating the ear are also relevant factors when considering potential causes of otitis externa following ear irrigation.

In the past the re-useable Jet Tips have been cleaned in various ways including holding under running water, using washing up liquid and using a sodium dichloroisocyanurate (NADCC) cleaning and decontaminating product, when cleaning the reservoir and tubing. This information was collected through a surgery survey in September 2004. The re-useable Jet Tips, which used to be sold with the electronic irrigator, have a narrow bore and air can remain trapped unless properly expelled prior to immersion in NADCC. The manufacturer

recognised the potential likelihood of variable cleaning standards by the multitude of users and replaced them with Disposable 'One Use' Jet Tips (which are individually wrapped) in September 2002. However, the obsolete re-useable Jet Tips are still in use in some practices on the grounds of economy and the assumption that there is a sufficient degree of cleanliness.

In this study microbiological tests were carried out on 120 re-useable Jet Tips collected from surgeries (selected from the previous survey) to determine the hygienic state of Jet Tips which were classified by the surgeries as clean and 'ready to use'.

### **Purpose of the study**

The purpose of this study was to determine the reliability of the cleaning procedures being used in surgeries by examining the 'ready to use' obsolete re-useable Jet Tips. Two of the 22 samples collected had not been cleaned in this manner. The study was also to highlight any hygiene issues with regard to potential risks of cross-infection. It is the duty of clinicians and employers to follow current guidelines in order to ensure a uniform level of cleanliness and eliminate the risk factors such as Hepatitis B in ear wax (Kalcioğlu, M. et al (2004)).

### **The study method**

Surgeries in 5 counties (Bedfordshire, Hertfordshire, Buckinghamshire, Cambridgeshire and Northants) where the electronic irrigator is used were identified and sent a survey questionnaire about their present irrigator cleaning policies. From the replies to this survey a list was compiled of those known to be still using the obsolete re-useable Jet Tips. These surgeries were then invited to be included in the research programme and the purpose of the study was discussed with them. They were assured that individual responses to the invitation would be regarded as strictly confidential and involvement in the study would be totally anonymous. The surgeries actually chosen for the study were those who were available on the day when the tips were collected in their area.

The obsolete re-useable Jet Tips from each surgery were collected on a daily basis, placed in a clinical specimen bag and a few drops of sterile saline were added to prevent drying out during transportation to the laboratory. Collected sample bags were sent by courier the same day to the laboratory and on receipt, were refrigerated until testing.

### **Microbiological tests**

All surgeries sent more than one Jet Tip and as these had been stored together at the place of use prior to the study, all the tips from any given location were pooled and tested together as one sample.

Each pooled sample of Jet Tips was tipped into a sterile screw-capped container containing 100ml of neutraliser-diluent (50ml of Eugon LT 100 Broth: Biomerieux UK Ltd + 50ml of Maximum Recovery Diluent: Biomerieux UK Ltd). The Jet Tips were allowed to soak in the neutraliser-diluent for 1 hour. Over this period, the Jet Tips were mechanically shaken at regular intervals to dislodge any micro-organisms present on them into the neutraliser-diluent.

A 0.5ml sample of the neutraliser-diluent from each screw-capped container was pipetted onto the surface of a basic set of microbiological culture plates and spread over the surface of the plates using disposable plastic spreaders. Each set of plates consisted of Blood Agar; MacConkey Agar; Pseudomonas Selective Agar and Baird-Parker Agar (see appendix 1) which were all incubated aerobically at 37°C for 48 hours and Sabouraud Dextrose Agar plates which were incubated aerobically at 25°C for 5 days. After incubation, viable counts were made of colonies of micro-organisms that had grown on the plates. **Counts of 1,000 plus are deemed to be an area of concern in hygiene terms**

**Results table of Total Viable Counts (TVCs) of micro-organisms which grew on the different types of culture media**

Jet Tip Source	Number of tips pooled in each sample	TVC's isolated on Blood Agar	TVC's isolated on MacConkey Agar	TVC's isolated on Baird-Parker Agar	TVC's isolated on Pseudomonas Selective Agar	TVC's isolated on Sabouraud Dextrose Agar
2	6	600	0	0	0	1,600
3	6	800	0	0	0	1,200
6	7	400	0	0	0	100,000
7	3	400	0	200	0	0
8	8	800	200	0	0	1,800
9	8	200	0	0	0	0
10	8	100,000	100,000	0	100,000	100,000
11	5	800	0	400	0	800
14	8	100,000	100,000	0	0	1,600
21	4	0	0	0	0	1,200
22	4	400	200	0	0	30,000
28	5	0	0	0	0	0
29	4	200	0	0	0	0
30A	5	100,000	100,000	400	100,000	100,000
30B	8	200	0	0	0	600
31	4	200	0	0	0	400
34	6	400	200	200	0	0
36	3	0	0	0	0	0
41	9	200	0	0	0	3,000
42	3	0	0	0	0	400
45A	3	100,000	100,000	0	0	100,000
45B	3	0	0	0	0	0
<b>Totals</b>	<b>120 (22)</b>	<b>77%</b>	<b>32%</b>	<b>18%</b>	<b>9%</b>	<b>68%</b>

The Jet Tip source codes 30A and 45A had provided tips which had not been cleaned and 30B/ 45B tips which had been cleaned ready for use with patients for comparison.

**Discussion**

1. The chart demonstrates the magnitude of the micro-organism counts on the tips that had not been cleaned, against those which had been cleaned. Given that counts of 1,000 plus are deemed to be an area of concern, the tips are a great risk of infection for patients if used without cleaning. However the 30B tips still had some micro-organism counts even though they had been cleaned.
2. It was not the purpose of this study to isolate and identify all specific pathogens which might have been present on the Jet Tips but to determine the general hygienic state of the tips following cleaning in the surgery. The method chosen to do this has previously been described.
3. The culture plates were only incubated aerobically. Consequently micro-organisms requiring other atmospheres for growth e.g. carbon dioxide-rich or anaerobic, would not have been isolated. Hence if such micro-organisms were present on the Jet Tips, then this study will have underestimated the total number of micro-organisms on the tips.

4. The necessary hollow cannula style of design of the obsolete re-useable Jet Tips make them hard to clean effectively. They have hollow cannula with a radius curve and a very narrow terminal lumen (Orifice). Repeated cleaning and disinfection may result in micro-etching of the inner surface, which will promote adherence of organic material. Some of the Jet Tips sent for testing were discoloured with age and showed signs of wear.
5. The methods of cleaning the obsolete re-useable Jet Tips at the various surgeries were not ascertained. However, as the surgeries knew that their Jet Tips were being sent to the laboratory for inclusion in micro-biological tests, it is assumed that the majority of Jet Tips would have been cleaned 'carefully' prior to collection, except the samples where it was stated that cleaning had not taken place. Hence it is surprising to find that many of the pooled samples remained contaminated after cleaning.
6. Previously recommended methods of cleaning the obsolete re-useable Jet Tips had to be followed carefully to be effective. However following this research which supports the manufacturer's decision of 2002 to use only the Disposable 'One Use' Jet Tips it is advised that the obsolete re-useable Jet Tips are no longer used. NADCC solutions rapidly lose strength after preparation so must be prepared fresh each day. They are inactivated by organic matter so the obsolete re-useable Jet Tips had to be scrupulously cleaned prior to immersion. 100% contact between the tip surface and the disinfectant was required to achieve disinfection. Hence if any air bubbles remained in the lumen of the tip then disinfection of the inner surface was incomplete. Drying of the tips after the disinfection process was extremely important. Guidelines previously laid down for cleaning the obsolete re-useable Jet Tips are no longer relevant following this research which shows the majority of cleaning has been inadequate or variable compromising the level of hygiene in the procedure. As the standard of hygiene varies enormously only the Disposable 'One Use' Jet Tip should be used with the machine according to the present guidelines. Bacteria such as *Pseudomonas* can rapidly proliferate in wet conditions (Todar, 2004) hence the reason to encourage nurses to dry the ear meatus following irrigation and recognise any potential causes of otitis externa. If just one or two bacteria survive the disinfection process, then they can multiply overnight into millions of new bacteria in the warm moist environment (Todar, 2004).
7. The micro-biological tests were carried out on 120 Jet Tips in 22 pooled samples from surgeries in 5 counties as previously described.

## **Study Results**

Using Blood Agar – Contaminants were isolated from 17 (77%) of the pooled samples with 4 counts > 100,000 (2 of these samples were the uncleaned tips which would be expected to be contaminated). The contaminants were mixed. No beta-haemolytic *Streptococci* (potential pathogens) were found.

Using MacConkey Agar – Contaminants were isolated from 7(32%) of the pooled samples with 4 counts > 100,000 (again 2 of these samples were the uncleaned tips). These 7 samples also had contaminants in the Blood Agar count (that is 7 of the 17 had viable counts on both types of culture media.)

Using Baird-Parker Agar - *Staphylococcus* was isolated from 4(18%)of the pooled samples in low numbers. These 4 samples also had contaminants in the Blood Agar count and 2 of these 4 samples had contaminants in all 3 counts. However, only 1 of the samples of the 2 unclean specimens was included in this group.

Using Pseudomonas Agar – Pseudomonas was isolated from just 2(9%) of the pooled samples. Both counts were > 100,000. One of these samples was an uncleaned specimen and had contaminants isolated on all the Agar tests. The other sample has also had contaminants isolated on 2 other types of culture media.

Using Sabouraud Dextrose Agar – Mixed contaminants were isolated from 15(68%) of the pooled samples with 4 counts > 100,000 (2 of these were the uncleaned samples). However, 11 of the samples have counts over 1,000 all but 1 of these samples also had Viable Counts in the Blood Agar test. With 11 samples harbouring significant counts of fungus or yeast micro-organisms on tips, which were believed to be clean, this is a major cause for concern.

As a count of 1,000 plus is deemed to be an area of concern in hygiene terms it can be seen from the results table that 11(50%) of the pooled samples are NOT an area for concern even though **only 3(13.6%) pooled samples are shown to be totally free** of contaminants identified by these tests.

## Conclusion

86% of the total samples showed some contamination whilst 11% of these samples contained high enough levels of contamination to present a clear infection control concern. One Disposable ‘One Use’ Jet Tip should be used per patient in order to eliminate this risk.

## References

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## Appendix 1

Explanation of Agar plates used in the study

1. Blood Agar – a general purpose medium rich in nutrients and growth factors that enable growth of more nutritionally-demanding micro-organisms.
2. MacConkey Agar (Biomérieux UK Ltd) – a selective medium for Enterobacteriaceae (gut) organisms e.g. Escherichia coli which is a major cause of infections. This has been found in babies with an ear infection.
3. Baird-Parker Agar (Biomérieux UK Ltd) – a selective medium for Staphylococcus bacteria (skin organisms) including Staph. Aureus which is a major cause of skin infections, boils and open wound infections.
4. Pseudomonas Selective Agar CFC (Biomérieux UK Ltd) – a selective medium for the isolation of Pseudomonas bacteria which are Gram-negative aerobic environmental organisms, capable of causing serious infections and are resistant to many antibiotics. Pseudomonas aeruginosa usually only infects compromised tissue and commonly inhabits water, soil and plants. This bacterium often inhabits the external auditory canal in association with wet conditions, inflammation or injury to the skin (Todar, 2004)
5. Sabouraud Dextrose Agar (Biomérieux UK Ltd) – a selective medium for the isolation and enumeration of fungi and yeasts such as Candida and Aspergillus which can be a cause of very resistant chronic otitis externa.