

# Assessing patient preference for two types of elastomeric infusion device

Susan Dodd

## Abstract

Home administration of antibiotic therapy to cystic fibrosis patients is one of many applications for the use of elastomeric infusion devices. Patient acceptability can significantly affect adherence to complex drug regimens with concordance being a concern in this patient population. While patient acceptance is often cited as a factor in pump selection, patient preference has not been assessed within a particular class of infusion device. The objective of this study was to assess patient preference for one type of elastomeric infusion device (Baxter Intermate® – hard-shelled design) or another (Fresenius Kabi Eclipse® – soft-shelled design). Twenty-four patients entered the study. 20/24 (83%) patients expressed a preference for the Eclipse®, while 4/24 (17%) stated no preference for either device. The Eclipse® device was found to be much more favourable in terms of comfort and discreetness. Patient preference should therefore be given significant consideration in order to maximize concordance with drug regimens.

**Key words:** Elastomeric ■ Home therapy ■ Infusion device ■ Intravenous ■ IV therapy ■ Patient preference

Elastomeric infusion devices are widely used in hospital and home-care settings to deliver drugs for chemotherapy, pain management, chelation therapy and antibiotic treatment. In studies, patients have indicated preference for these types of devices over standard infusion devices because of their weight, size, less interference with daily activities and user friendliness (Veal et al, 1995; Zahnd et al, 1999; Capdevila et al, 2003).

A number of elastomeric devices are now available on the UK market offering various flow rates and infusion times, with differing physical features. Many factors require consideration when selecting such a device. Physical characteristics can influence patient comfort (Device Evaluation Service [DES] and the National Patient Safety Agency [NPSA], 2005). While patient acceptance is often cited as a factor in pump selection (Schleis and Tice, 1996; Skryabina and Dunn, 2006), the majority of literature focuses on pump performance

only (Veal et al, 1995; Capes and Asiimwe, 1998; Thiveaud et al, 2005).

Home therapy is well established in the management of cystic fibrosis patients with elastomeric pumps typically used to administer antibiotics. Cystic fibrosis units usually select one pump design for use in this setting. Given the lack of research in the area, this study aims to assess patient preference for two different designs of elastomeric device.

## Background

An elastomeric infusion device is a disposable pump comprising an elastomeric reservoir (containing the drug) that is contained within an outer protective shell, and a flow restrictor system within the administration set. The flow rate is determined by the pressure in the filled reservoir, flow control tubing and the flow restrictor.

In the United Kingdom, elastomeric pumps are available from a number of manufacturers. These products differ from each other in the type of elastomer used for the fluid reservoir, the range of reservoir volumes and flow rates, and the claimed level of accuracy (DES and NPSA, 2005). Variables including acceptable infusion rate accuracy, desired infusion duration, infusion-rate profile, total drug volume and

patient acceptance should be taken into account when selecting such a device (Skryabina and Dunn, 2006). The relevance of these factors varies in the literature. Delivery time accuracy and consistency are noted as the main criteria in pump selection in one study (Thiveaud et al, 2005). Another review comments that patients' needs and type of therapy to be administered are the most important considerations (Schleis and Tice, 1996).

Differing physical characteristics tend to lie within the outer protective shell. This can either be a conformable PVC bag (Figure 1, e.g. Fresenius Kabi Eclipse® Homepump E-Series and C-Series) or a more rigid plastic (e.g. Baxter Intermate®). These characteristics can influence patient comfort (DES and NPSA, 2005). It has been suggested that a soft outer shell may offer less protection against puncture. On the other hand the smaller profile for storage and disposal of the unfilled soft shelled devices can offer advantages. The residual volume (volume of drug remaining in the device on completion of infusion) and consequent wastage of drug are also influenced by physical design. (Pump characteristics for Eclipse® and Intermate® can be found in Box 1.)

Patients who want to give their infusions unobtrusively at work or school and those with manual dexterity problems are obvious candidates for these types of pumps (Schleis and Tice, 1996).

## Home care in cystic fibrosis

The benefits of home treatment in this patient population have been well documented (Gilbert et al, 1988; Kuzemko, 1988; Strandvik et al, 1992; Pond et al, 1994; van Aalderen et al, 1995; Marco et al, 2000). A full review of this subject is outside the scope of this article and only the points pertinent to the study are addressed here.

Both adult and paediatric cystic fibrosis patients are managed in the home-care setting. Intravenous home therapy has contributed to improved quality of life via the reduction in number of hospital admission days. The importance of control of pulmonary exacerbations has been demonstrated through correlation with improved survival (van Aalderen et al, 1995).

Susan Dodd is Senior Sister, Infection and Travel Medicine, Gledhow Wing, St James's University Hospital, Leeds

Accepted for publication: October 2007

Long-term antibiotic therapy can involve multi drug regimens, often administered via ambulatory infusion device up to four times daily over an average of 2 weeks per treatment course. Patient acceptability can significantly affect concordance with drug therapy. D'Angelo (1996) demonstrated concordance is worst for components either causing unpleasant side-effects or intruding on daily life. One study in adults has demonstrated that 70% of patients miss five or more doses of antibiotics per treatment course (Phillips, 1997).

### Literature review: patient preference

PubMed (1980 to present) was searched for relevant research, while the Department of Health, National Institute for Health and Clinical Excellence and the MHRA websites were searched for guidelines specifically relating to patient preference and infusion devices.

None of the government-funded websites could provide any information relating to patient preference in this area. A number of studies related to pump performance, accuracy and cost (Valente and Aldrete, 1997; Capes and Asimwe, 1998; Thiveaud et al, 2005) but only three studies addressed patient preference or acceptability (Rich, 1992; Zahnd et al, 1999; Capdevila et al, 2003).

Zahnd et al (1999) assessed patient preference for an elastomeric device compared to an electronically controlled mechanical pump. The researchers discovered that patients unequivocally preferred the elastomeric device due to lower pump weight and size, and less interference with daily activities. Similar findings were reported by Capdevila et al (2003).

An earlier study (Rich, 1992) evaluated the Homepump (Block Medical, Carlsbad, CA) in 55 patients via a nurse and pharmacist evaluation form. The device was shown to be acceptable due to low failure rates and high degree of nurse and patient preference.

Much of the literature mentions patient acceptability as a factor in device selection but nowhere is patient preference assessed within a particular class of infusion device. Given the importance of pulmonary management in



Figure 1. Eclipse® Homepump elastomeric infusion device series.

## Box 1. Pump characteristics

	Eclipse® Homepump E-Series	Intermate®
Manufacturer	I-Flow Corporation, USA	Baxter Healthcare Corporation, USA
UK Supplier	Fresenius Kabi Ltd, Cheshire	Baxter Healthcare Ltd, Berkshire
Outer shell	Soft	Hard

relation to outcome in cystic fibrosis patients, and studies demonstrating questionable patient concordance with antibiotic treatment, it seems logical to give consideration to patient preference and to assess which type of pump patients prefer.

### Research aim

This study aimed to assess patient preference for two differing pump designs – the Eclipse® and the Intermate®.

### Patients and methods

During a 3-month period in 2003, both adult and paediatric cystic fibrosis out-patients at St James's and Seacroft hospitals who had previously received antibiotic therapy via the Intermate® device received one course of treatment via the Eclipse® pump. The devices were filled by the homecare company and supplied to patients ready for infusion. No additional training over and above the standard provided for new device users was given.

### Access to patients

Informed consent was given before study inclusion. The study proposal was discussed by the cystic fibrosis multidisciplinary team across the two sites. Study approval was given by the director of the unit. Patients were invited to participate as they presented on the unit; if they declined they continued to receive antibiotic treatment via their usual infusion device.

### Patient questionnaire

At the end of the study period each patient was given a structured questionnaire to complete, evaluating patient preference for one of the devices. Adult patients self-completed and paediatric patients were assisted by their parents where necessary. Infusion time accuracy was recorded in terms of actual and nominal (the infusion time stated on the device) times. The questionnaire (Box 2) enabled patients to score the two devices in terms of comfort and discreetness (ranking from 1–10 with 10 being very comfortable or very discreet). Overall preference was also assessed. An open-ended facility was provided for further comments. These further comments were then analysed to identify emergent themes and categories.

### Rationale for study design

The main aim was to assess patient preference for one of two elastomeric devices. Use of a ranking scale generated a rating and enabled assessment of preference. To a certain extent the research was exploratory as it was not known:

- Which factors patients may prefer in their infusion devices
- If there are any other elements patients consider important in relation to their infusion device.

The open-ended facility enabled patients to write their comments as appropriate, to facilitate identification of emergent themes.

### Results

Twenty-four patients entered this study. All study subjects had good performance status at the start of the study period. None of the patients expressed conditions that would limit the use of the pump.

### Infusion data

Twenty-three patients submitted data relating to number of drugs infused and duration of infusion. Of these, 20 patients received two different antibiotics throughout the study period and three received one antibiotic. Actual durations of infusion ranged from 15–75 minutes. Eight patients noted that nominal and actual infusion times corresponded exactly. Mean variation in terms of actual infusion duration versus nominal duration was +7.38% (range -30% to +67%).

### Pump usage and preference

None of the patients had problems with either connecting or priming their Eclipse® device. Mean preference scores are found in Table 2.

Overall, 20/24(83%) patients expressed preference for the Eclipse® with 4(17%) stating they had no preference (Figure 2). No patients stated a preference for the Intermate® device.

### Content analysis

Themes relating to feedback emerged in one of three areas (Table 3): pump design, infusion time accuracy and characteristics affecting pump usage.



### Pump design

Seven of the participants provided comments relating to the design of the Eclipse® device; however, one of these did not have a preference for either the Eclipse® or the Intermate®. All the comments provided in terms of pump design were positive.

Benefits of a smaller pump were noted in terms of less physical space (waste, storage and usage) and greater portability:

**'I found the Eclipse a lot lighter to carry than the Intermate. Overall the Eclipse is better in size comfort and weight to the Intermate.'**  
(Participant 2)

The lack of bulky casing was mentioned as a contributing factor to ease of handling; and the reduction in pump size during infusion was also seen as a benefit.

### Infusion time accuracy

Infusion time accuracy was mentioned by five of the respondents. All five indicated either equivalent or improved performance for the Eclipse® pump compared with the Intermate®:

**'Eclipse much better. I found the drugs took the amount of time specified on the label to infuse.'**  
(Participant 5)

All five also expressed a preference for the Eclipse®. Of the four stating no preference for either device, three experienced actual infusion times longer than the label specified. None of these respondents, however, provided longer infusion time as a reason for lack of preference. Variation in infusion time was noted for both the Eclipse® and the Intermate®:

**'Infusion times did vary a bit but also varied with Intermates.'** (Participant 6)

### Characteristics affecting pump usage

A number of the respondents commented on the favourable ease of use of the Eclipse® (including ease of pump connection and presence of a filter). One respondent indicated greater correct usage assurance as a benefit to the Eclipse®:

**'I found the most important difference is that when you begin your drugs you know within 1 minute they're going through as there is air between the drug container and the bag. Before it could be 10 minutes or so before**

### Box 2. Patient questionnaire

**We are currently trying a different device (the Eclipse) to infuse your antibiotics. We would be grateful if you could answer a few questions about your experience using the Eclipse.**

- |   | Drug 1             | Drug 2        |
|---|--------------------|---------------|
| <b>1.</b>   |                    |               |
| a) What is the infusion time on the label?                                    |                    |               |
| b) How long did it actually take to infuse?                                   |                    |               |
| <b>2.</b>   |                    |               |
| Which of the following did you prefer to use to carry your Eclipse?           |                    |               |
| a) Bumbag   |                    |               |
| b) Clothing clip  |                    |               |
| c) Other  |                    |               |
| d) Nothing  |                    |               |
| <b>3.</b> How did you carry your Intermate?                                   |                    |               |
| <b>4.</b>   |                    |               |
| a) Did you have any problems connecting your device?                          |                    |               |
| No  | Yes (please state) |               |
| b) Did you have any problems priming your line?                               |                    |               |
| No  | Yes (please state) |               |
| <b>5.</b>   |                    |               |
| a) How comfortable did you find the Eclipse to carry? (10=very comfortable)   |                    |               |
| 1    2    3    4    5    6    7    8    9    10                               |                    |               |
| b) How comfortable did you find the Intermate to carry? (10=very comfortable) |                    |               |
| 1    2    3    4    5    6    7    8    9    10                               |                    |               |
| <b>6.</b>   |                    |               |
| a) How discreet did you find the Eclipse? (10=very discreet)                  |                    |               |
| 1    2    3    4    5    6    7    8    9    10                               |                    |               |
| b) How discreet did you find the Intermate (10=very discreet)                 |                    |               |
| 1    2    3    4    5    6    7    8    9    10                               |                    |               |
| <b>7.</b> Overall, do you prefer the:   |                    |               |
| Intermate   | Eclipse            | No preference |
| <b>8.</b> Please add further comments   |                    |               |

**you realized it wasn't connected right.'** (Participant 3)

Four respondents did highlight they would prefer a clear outer casing and/or the opaque outer bag limited ease of identification of infusion completion:

**'Outer bag – I would recommend it be a clear bag to enable us to judge better whether the drug has totally completed.'** (Participant 24)

Two of these four stated no preference for either device; the other two favoured the Eclipse®.

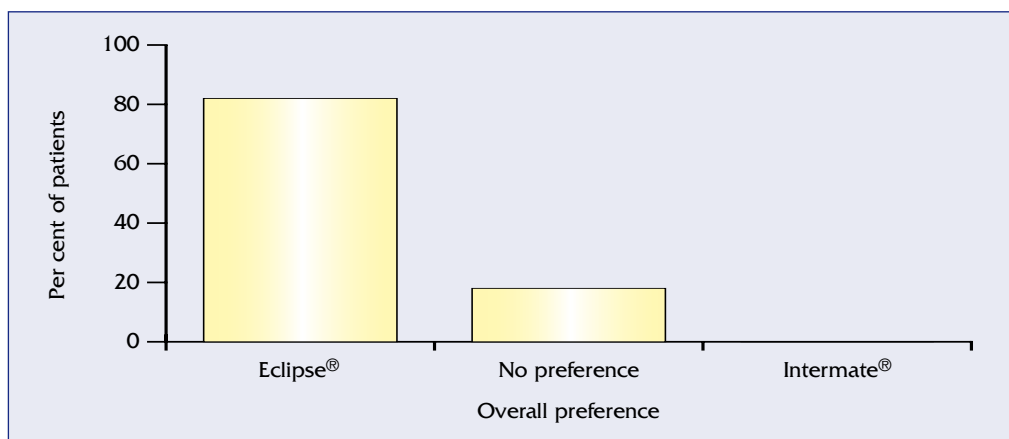
### Discussion

Comfort and discreetness are evidently contributing factors to patient preference

with the Eclipse® device performing better than the Intermate® on both elements. As expected, based on literature review, the Eclipse® pump design in terms of weight and size was seen as beneficial by the respondents. (It is worth noting that both pumps come in a range of sizes which may vary in terms of physical impact.)

Mean infusion time accuracy was well within the accepted industry standard of  $\pm 15\%$ . There was, however, a wide variation in infusion time accuracy seen. Variations in infusion time accuracy have been demonstrated in earlier research (Thiveaud et al, 2005). The wide variations seen in this study may be due to the fact that short duration devices were used whereby even small variations in infusion time would result in large percentage variations in accuracy. It would seem, however, that patients

Figure 2. Patient preference for type of infusion device.



do expect some degree of variation from labelled infusion times and that variations will be seen regardless of device used.

In general, remarks relating to usage practicalities were positive. One limitation of the Eclipse® design could be the opaque nature of the outer casing which, in this study, seemed to hinder identification of infusion completion. The research results nevertheless do not indicate that this is an overriding factor for patient preference. The high degree of patient acceptability of this device supports the results of Rich's study from 1992.

### Research limitations

The lack of a control group could be identified as a weakness of this study. Further research could address this issue via the use of a cross-over study. Given that the questionnaire focused predominantly on feedback regarding the Eclipse® device only, participant bias may affect the findings.

**Table 2. Mean values ± standard deviation for Eclipse® versus Intermate®**

	Eclipse®	Intermate®
Comfort	9.02 (± 1.01)	5.77 (± 2.11)
Discreetness	8.02 (± 1.46)	4.77 (± 2.47)

**Table 3. Emergent themes and identification terms**

Theme	Sample identification terms
Pump design	Size, comfort, weight, space, discreet, casing, waste, waste disposal
Infusion time accuracy	Went through, infusion times, time
Characteristics affecting pump usage	Outer bag, completed infusion, finished bottle, filter, connection

The research failed to address the relationship between patient preference and compliance with antibiotic therapy. Given previous research (Phillips, 1997), indicating significant non-compliance with antibiotic treatment, this could be a potential area for further research. Similarly, future research may explore further which factors patients consider important in infusion device usage and the effect improved concordance has on patient outcomes.

Despite these limitations, this is one of very few studies assessing patient preference in an area where therapy concordance is dictated by patient behaviour. In support of Schleis and Tice (1996), the practical application of these data is for patient choice to be given the utmost consideration when selecting an infusion device.

### Conclusions

In addition to numerous comments regarding the Eclipse® design, infusion time accuracy and ease of use were cited as benefits and this study clearly demonstrates cystic fibrosis patients prefer the Eclipse® device over the Intermate®. Given the extensive use of ambulatory devices in the home-care setting, patient preference should be given significant consideration in order to maximize concordance with drug regimens. The results of this study are encouraging for other applications of elastomeric devices where concordance or patient acceptability may be a concern. BJN

Capdevila X, Macaire P, Aknin P, Dadure C, Bernard N, Lopez S (2003) Patient-controlled perineural analgesia after ambulatory orthopedic surgery: a comparison of electronic versus elastomeric pumps. *Anesth Analg* **96**(2): 414–17

Capes DF, Asiimwe D (1998) Performance of selected flow-restricting infusion devices. *Am J Health Syst Pharm* **55**(4): 351–9

D'Angelo S (1996) Basic concepts of adherence in cystic fibrosis. *Israel J Med Sci* **32**(Suppl June)

Device Evaluation Service and National Patient Safety Agency (2005) *Report 05055 Market Survey: Non-electrically powered disposable infusion devices*. DES and NPSA, London. Available at: [www.pasa.nhs.uk/pasa/Doc.aspx?Path=%5BMN%5BSP%5D/NHSprocurement/CEP/Infusionpumps/Report%2005055.pdf](http://www.pasa.nhs.uk/pasa/Doc.aspx?Path=%5BMN%5BSP%5D/NHSprocurement/CEP/Infusionpumps/Report%2005055.pdf) (last accessed 16 October 2007)

Gilbert J, Robinson T, Littlewood JM (1988) Home intravenous antibiotic treatment in cystic fibrosis. *Arch Dis Child* **63**(5): 512–17

Kuzemko JA (1988) Home treatment of pulmonary infection in cystic fibrosis. *Chest* **94**(2 Suppl): 162S–166S

Marco T, Asensio O, Bosque M, de Gracia J, Serra C (2000) Home intravenous antibiotics for cystic fibrosis. *Cochrane Database Syst Rev* (4): CD001917

Phillips AM (1997) Home intravenous antibiotic therapy: practical aspects in adults. *J R Soc Med* **90**(Suppl 31): 34–6

Pond MN, Newport M, Joanes D, Conway SP (1994) Home versus hospital intravenous antibiotic therapy in the treatment of young adults with cystic fibrosis. *Eur Respir J* **7**(9):1640–4

Rich DS (1992) Evaluation of a disposable, elastomeric infusion device in the home environment. *Am J Hosp Pharm* **49**(7): 1712–16

Schleis TG, Tice AD (1996) Selecting infusion devices for use in ambulatory care. *Am J Health Syst Pharm* **53**(8): 868–77

Skryabina EA, Dunn TS (2006) Disposable infusion pumps. *Am J Health Syst Pharm* **63**(13): 1260–8

Strandvik B, Hjelte L, Malmberg AS, Widen B (1992) Home intravenous antibiotic treatment of patients with cystic fibrosis. *Acta Paediatr* **81**(4): 340–4

Thiveaud D, Demazieres V, Lafont J (2005) Comparison of the performance of four elastomeric devices. *European Journal of Hospital Pharmacy (Practice Journal)* **2**: 54–6

Valente M, Aldrete JA (1997) Comparison of accuracy and cost of disposable, nonmechanical pumps used for epidural infusions. *Reg Anesth* **22**(3): 260–6

van Aalderen WM, Mannes GP, Bosma ES, Roorda RJ, Heymans HS (1995) Home care in cystic fibrosis patients. *Eur Respir J* **8**(1): 172–5

Veal DF, Altman CE, McKinnon BT, Fillingim O (1995) Evaluation of flow rates for six disposable infusion devices. *Am J Health Syst Pharm* **52**(5): 500–4

Zahnd D, Aebi S, Rusterholz S, Fey MF, Borner MM (1999) A randomized crossover trial assessing patient preference for two different types of portable infusion-pump devices. *Ann Oncol* **10**(6): 727–9

### KEY POINTS

- Elastomeric infusion devices are widely used in both hospital and home-care settings.
- Factors affecting patient acceptability can significantly affect concordance with drug regimens.
- Patient preference for a particular infusion device is influenced by device comfort and discreetness.
- When selecting such a device, patient preference should be given significant consideration in order to maximize concordance with drug regimens.