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Investigation of practices and procedures in the use of therapeutic diathermy: a study from the physiotherapists' health and safety perspective

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ABSTRACT **Background and Purpose**. *The safe use of therapeutic diathermy requires practices and procedures that ensure compliance to professional guidelines and clinical evidence. Inappropriate use may expose physiotherapists and other people in the vicinity of operating diathermy devices to stray radiofrequency electromagnetic fields, which can be a source of risk and may lead to adverse health effects. The aim of the present study was to investigate practices and procedures for therapeutic diathermy from a health and safety perspective.* **Method**. *A cross-sectional research design was used, this included a postal survey using a self-administered questionnaire and semi-structured observational visits to 46 physiotherapy departments in National Health Service (NHS) hospitals located in the south-east and south-west of England, including Greater London.* **Results**. *Microwave diathermy was not available in the departments surveyed. Pulsed shortwave diathermy was available and was used more commonly than continuous shortwave diathermy. There were metallic objects in treatment cubicles used for pulsed shortwave diathermy and continuous shortwave diathermy. Shortwave diathermy devices created electromagnetic interference with a variety of electrical and medical devices. Physiotherapists reported that they did not stay in the treatment cubicle during the entire period of electrotherapy with pulsed shortwave diathermy or continous shortwave diathermy; pregnant physiotherapists reported that they did not use these devices. Electrotherapy with pulsed shortwave diathermy and continuous shortwave diathermy was not always administered on a wooden couch or chair. Electrotherapy was highest in those departments with the fewest physiotherapists.* **Conclusions**. *Departments report good practices and procedures regarding the use of therapeutic diathermy devices. However, field observations of practices and procedures, and the working environment, have identified issues with a potential to create health and safety problems, and these should be addressed. Copyright © 2007 John Wiley & Sons, Ltd.*

Key words: health and safety, physiotherapist, practices and procedures, therapeutic diathermy

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INTRODUCTION

Physiotherapists use different forms of electromagnetic energy for therapeutic purposes, such as radiofrequency non-ionizing radiation via shortwave diathermy, used as either pulsed or continuous, and microwave diathermy devices (Allen, 1991; Tzima and Martin, 1994; Belanger, 2002). However, inappropriate use of these devices may cause emission of stray radiofrequency electromagnetic fields to which physiotherapists can be unintentionally and unnecessarily exposed (Cooper, 2002). Such stray radiofrequency fields have been measured and found to be higher than permissible levels (Stuchly et al., 1982; Martin et al., 1990; Tzima and Martin, 1994; Lerman et al., 1996; Li and Feng, 1999; Tuschl et al., 1999; Shields et al., 2004a). These findings may be associated with adverse effects for physiotherapists' health (Gormley, 2000). Examples of adverse effects include spontaneous abortion, stillbirth, congenital malformations, low birth weight and alteration to the gender ratio (Kallen et al., 1982; Taskinen et al., 1990; Larsen et al., 1991; Ouellet-Hellstrom and Stewart, 1993; Lerman et al., 2001), ischemic heart disease (Hamburger et al., 1983), burning, local aching, general giddiness and bone ache (Kitchen, 1995). Adverse reproductive outcomes have not been corroborated (Larsen, 1991; Guberan et al., 1994; Cromie et al., 2002) and no consistent causal relationship between radiofrequency electromagnetic fields and adverse health effects has yet been established (Shields et al., 2003b; Ahlbom et al., 2004).

Stray electromagnetic fields from diathermy devices can extend to neighbouring electrotherapy rooms, corridors and adjacent areas (Aniolczyk et al., 2004) and may be a risk to patients, physiotherapists or other people in these areas (Benetazzo et al., 2003).

To limit unintentional exposure to electromagnetic fields up to 300 GHz, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) has issued guidelines for both the general public and workers (ICNIRP, 1998), which have been adopted in the UK (NRPB, 2004). The European Community has issued Directive 2004/40/EC to limit exposure to physical agents (electromagnetic fields) to protect the health and safety of workers (European Community, 2004). The protection of workers' health and safety in the UK requires compliance with the Health and Safety at Work Act 1974 (HMSO, 1974) and the Management of Health and Safety at Work Regulations 1992 (HMSO, 1992).

Operating electrotherapeutic diathermy devices can cause electromagnetic interference with other electrotherapy devices and with devices including electrocardiograms, electroencephalograms, physiological monitors, cardiac pacemakers, defibrillators and hearing aids (Robinson et al., 2003). Thus, the mitigation of electromagnetic interference by therapeutic diathermy is essential (Wilton, 1994).

The safe use of diathermy devices and avoidance of potential risks to physiotherapists and patients is underpinned by professional standards, safety codes and guidelines delineating their safe use and practices and procedures (Health Canada, 1983; NHMRC, 1986a, 1986b; Docker et al., 1992, 1994; CSP, 1997a, 1998; Health Canada, 1999; CSP, 2000). These include:

- training in the safe use of the devices
- determination of a safe distance between the operator and the device being operated
- use and maintenance of devices as per the manufacturer's manual

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- use of a non-metallic treatment couch or chair
- the absence of large metallic objects in the vicinity of diathermy devices
- determination of an appropriate size for the treatment cubicle
- avoidance of electromagnetic interference produced by diathermy devices
- instructions for pregnant physiotherapists (Health Canada, 1983; NHMRC, 1986a, 1986b; Wilton, 1994; CSP, 1997a, 1998; Health Canada, 1999; CSP, 2000; Robertson et al., 2001).

Research about physiotherapists' health, and safety issues from therapeutic diathermy has mainly focused on the measurement of stray radiofrequency electromagnetic fields from microwave diathermy and shortwave diathermy devices (Stuchly et al., 1982; Skotte, 1986; Martin et al., 1990; Tzima and Martin, 1994; Lerman et al., 1996; Li and Feng, 1999; Tuschl et al., 1999; Shields et al., 2004a; Gruber and Gewehr, 2006). However, some researchers have investigated the safe use of these devices (Delpizzo and Joyner, 1987; Martin et al., 1991; Docker et al., 1992; Shields et al., 2002a) and reported that safety measures taken during the use of shortwave diathermy devices are inappropriate (Shields et al., 2002a).

The present study investigates practices and procedures in the use of microwave diathermy and shortwave diathermy in physiotherapy departments in the NHS in England from the physiotherapists' health and safety perspective.

METHOD

Study design

This cross-sectional study included a postal survey using a self-administered 'practices and procedure' questionnaire and semi-structured observational visits to 46 physiotherapy departments in NHS hospitals in the south-east and south-west of England, including London.

Participants

A list of 107 NHS physiotherapy departments within an approximately 50-mile radius of London enabled 57 departments to be randomly selected, with no exclusion criteria. Large departments in urban hospitals and small physiotherapy clinics at the community level were included. Given the widespread geographical location and mix of urban, rural, large and small departments, the sample was considered representative of NHS physiotherapy departments in the study area.

The physiotherapy departments selected were contacted via telephone and letter to request their participation in the study, which was confirmed by return of a signed consent form. Two departments were not interested in the study and nine did not respond despite lengthy correspondence. After consent was received, a self-administered survey questionnaire with covering letter was sent to the physiotherapy departments requesting an appointment for a visit to each department.

Survey questionnaire and pilot study

A self-administered 'practices and procedure' questionnaire was developed, containing both closed- and open-ended questions, after a review of published literature on health and safety issues associated with therapeutic diathermy. Questions related to diathermy devices, treatment, department and operation of the devices. The content validity of the questionnaire was checked by a rigorous and iterative process by experts

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who were members of academic staff in occupational health and safety and physiotherapy.

The questionnaire was pre-tested on six chartered physiotherapists, and revised in the light of feedback received. Revalidation of the revised questionnaire involved a pilot study in seven physiotherapy departments, including a postal survey and semi-structured observational visits. Subsequent to the pilot study, the questionnaire was further revised, and extra questions were included on the number of physiotherapists in the department, the average number of patients per week, the percentage of patients treated with diathermy per week, electrical interference during diathermy, occurrence of electrotherapy audit and any contraindications or precautions for physiotherapists when operating therapeutic diathermy modalities.

Main study

Thirty-nine physiotherapy departments were involved in the main study, which included a postal survey using the final version of the questionnaire and the observational visits.

Observation study

Discussion with the manager or superintendent physiotherapist alongside semi-structured observations of diathermy treatment cubicles were undertaken from an occupational health and safety perspective. Measurement of the size of treatment cubicles used for diathermy, the nature of the partition between treatment cubicles, the presence of any large metallic objects within cubicle areas, dates of electrical safety checks and calibration tests shown on diathermy devices and any health and safety warning signs or notices in the departments were recorded. The visits did not involve observing patients and physiotherapists during electrotherapy procedures.

Data collection and analysis

Data were collected between October 2002 and July 2003. The Statistical Package for Social Sciences (SPSS) Version 11.5 for Windows was used for data compilation and analysis. The response rate of the study was 81%.

RESULTS

Departmental issues

The number of physiotherapists working in the departments ranged from 3 to 34 (mean 13; (SD) 6) physiotherapists). During one week the number of patients visiting a department was between 44 and 1200 (mean 418; SD 260) and, of these, between 0.33% and 50% (mean 20%, SD 15%) were treated with electrotherapy.

The number of physiotherapists in the departments was significantly and positively correlated with the number of patients visiting a department in a week (Pearson's $r = 0.3$; $p < 0.05$). But the number of physiotherapists was significantly and negatively correlated with the percentage of patients treated with electrotherapy (Pearson's $r = -0.4$; $p < 0.05$). The departments with the fewest physiotherapists therefore carried out the greatest number of electrotherapy treatments each week.

An electrotherapy audit was reported by 21.7% of departments, 50% reported that no audit had taken place and 10.9% did not know; the remaining departments gave no information.

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Equipment issues

Microwave diathermy devices were not available in the study departments. Pulsed shortwave diathermy and continuous shortwave diathermy devices were available in 93.5% and 30.4% of departments, respectively. There were one to six devices for pulsed shortwave diathermy and one to three for continuous shortwave diathermy per department. Pulsed shortwave diathermy was used more frequently than continuous shortwave diathermy (Table 1).

The technique in the application of any shortwave diathermy modality was reported as 'inductive' in 65.2%, 'capacitive' in 13% and both inductive and capacitive in 4.3% of departments. The types of applicators or electrodes used were 'circuplode' in 65.2%, 'rigid metal disks' (disk electrodes) in 10.9% and 'flexible metal plates' (malleable electrodes) in 2.2% of departments.

The frequency of maintenance of pulsed shortwave diathermy and continuous shortwave diathermy devices, shown in Table 2, reveals that maintenance was carried out six-monthly in most departments. Maintenance was also verified during observational visits—from stickers on diathermy devices bearing the date of service, found mainly to be the electrical safety inspection. In departments where pulsed shortwave diathermy and continuous shortwave diathermy devices were available responsibility for equipment maintenance was placed with an in-house facility in 83.7% and 92.9%, respectively, and with contractors or suppliers in 14% and 7.1% of departments, respectively. One department did not provide any information for pulsed shortwave diathermy device maintenance.

A user manual for pulsed shortwave diathermy and continuous shortwave diathermy devices was available in 78.3% and 26.1% departments, respectively, and was not available in 10.9% and 4.3% of departments, respectively; 2.2% of departments did not provide this information for pulsed shortwave diathermy devices.

Electromagnetic interference during the use of shortwave diathermy (both pulsed and continuous) devices was reported by 34.8% of departments. In 30.4% of departments there was either no electromagnetic interference or the respondent did not know about it. No information was given by 19.6% of departments, and 8.7% replied that they did not use a shortwave diathermy device.

TABLE 1: Frequency of use of pulsed shortwave diathermy and continuous shortwave diathermy ($n = 46$)

Use	*PSWD (%)*	*CSWD (%)*
4–5 days/week	32.6	—
2–3 days/week	15.3	2.1
1 day/week	4.3	—
<1 day/week	32.6	8.7
Not used despite device availability	8.7	19.6
Equipment not available	6.5	69.6

PSWD = pulsed shortwave diathermy; CSWD = continuous shortwave diathermy.

TABLE 2: Maintenance frequency of pulsed shortwave and continuous shortwave diathermy devices

Maintenance	*PSWD (%)*	*CSWD (%)*
3–4 monthly	26	4.3
6-monthly	43.5	15.2
Annually	17.4	6.5
Bi-annually	2.2	—
When broken or faulty	2.2	2.2
Information not provided	2.2	2.2
Equipment not available	6.5	69.6

PSWD = pulsed shortwave diathermy; CSWD = continuous shortwave diathermy.

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The devices caused electromagnetic interference with the telephone in 26% of departments, with computers in 6.5%, with radio in 4.3% and the digital clocks of therapeutic laser, audio dictation and audiometer machines in 2.2% of departments.

Signs, written notices and warnings for users of cardiac pacemakers, metallic implants, and hearing aids were also observed.

Treatment issues

The mean treatment time with pulsed shortwave and continuous shortwave diathermy devices was 13.6 (SD 3.4) and 14.5 (SD 3.5) minutes, respectively, and the range was between 10 and 20 minutes.

Environmental issues

The size of cubicle or room used for treatment with pulsed shortwave diathermy and continuous shortwave diathermy devices varied from 2.6 m^2 to 20 m^2 (mean 7.2 m^2, SD 2.9 m^2).

The treatment cubicles were separated from other cubicles with a 'curtain partition and brick walls' in 71.7%, 'curtains and plasterboard or plywood walls' in 4.3%, 'brick walls' in 4.3% and 'special screened walls' in 2.2% of departments. The remaining departments did not provide any information.

During departmental visits, metallic objects, including radiators, heaters, chairs, cupboards, iron girders and springs, water pipes, filing cabinets, trolleys and metallic plinths were found in cubicles used for pulsed shortwave diathermy and continuous shortwave diathermy in 52.2% and 2.2%, of departments, respectively. The closest distance between these objects and the shortwave diathermy devices was approximately 0.25 m.

TABLE 3: Number of people in a treatment cubicle during electrotherapy with pulsed shortwave diathermy and continuous shortwave diathermy

	PSWD (%)	*CSWD (%)*
Patient	21.7	6.5
Physiotherapist exits treatment cubicle, leaving patient behind	28.3	2.1
Patient and physiotherapist	26.2	
Varies	4.3	2.1
Not used despite device availability	8.7	19.6
Information not provided	4.3	—
Equipment not available	6.5	69.6

PSWD = pulsed shortwave diathermy; CSWD = continuous shortwave diathermy.

Treatment plinths, couches or chairs used for pulsed shortwave and continuous shortwave diathermy devices were 'wooden' in 13% and 8.7% of departments and 'metallic and wooden' in 33.6% and 2.2% of departments, respectively. In 37% of departments a 'metallic' plinth was also used for pulsed shortwave diathermy devices.

Table 3 presents the number of people in a cubicle during electrotherapy with shortwave diathermy devices. The practice of 'setting', 'switching on the equipment' and then 'leaving the treatment cubicle' was reported for pulsed shortwave diathermy and continuous shortwave diathermy in 28.3% and 2.2% of departments, respectively. In these cases the patient was given instructions to use a bell to call for help for any problem. The physiotherapist might also visit the patient intermittently to check on them.

Operator issues

All departments, except two, reported staff receiving training or instruction about the safe use of pulsed shortwave diathermy and

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continuous shortwave diathermy. Fifty-seven per cent of departments reported that physiotherapists had attended refresher courses within the last two years. However, comments of 'no set timetable', 'no training since qualification but awaited', 'no regular training' and 'juniors go routinely but do not know about seniors' were also reported.

The operator distance from pulsed shortwave diathermy and continuous shortwave diathermy devices was 1–2 m in 23.9% and 2.2% of departments, respectively, and >2 m in 28.3% and 6.5% of departments, respectively. The remaining departments did not provide information, mainly owing to either non-availability or non-use of these devices.

Contraindications for physiotherapists using microwave diathermy devices and shortwave diathermy devices for treating patients was addressed in a list of 12 conditions (Table 4) prepared by the authors from the literature (Docker et al., 1992,1994; Shields et al., 2002b; Shields et al., 2004b). Thirty-nine departments were asked for opinions about using or not using microwave diathermy and shortwave diathermy modalities if they had any of the listed conditions. No departments provided responses for microwave diathermy since it was not available. Responses from departments using pulsed shortwave diathermy and continuous shortwave diathermy are shown in Table 4. Pregnancy, having a cardiac pacemaker and malignancy were reported as the top three conditions where use of both pulsed shortwave diathermy and continuous shortwave diathermy devices by physiotherapists were recorded as contraindicated.

TABLE 4: Contraindications for use of pulsed shortwave diathermy and continuous shortwave diathermy devices by physiotherapists

Contraindication	*PSWD (n = 33)[a] (%)*	*CSWD (n = 5)[a] (%)*
Pregnancy	94	80
Cardiac pacemaker	85	80
Malignancy (past or present)	61	40
Infection/tuberculosis	36	20
Metal in tissues	27	20
Fever	24	—
Epilepsy	21	40
Deep vein thrombosis	18	20
Cardiac arrhythmia	18	40
Skin conditions	12	—
Menstruation	12	0
Use of anticoagulants	9	20

[a] Total number of departments in the main study where this modality was used.
PSWD = pulsed shortwave diathermy; CSWD = continuous shortwave diathermy.

DISCUSSION

In the present study, the response rate (80%) was higher than in previous studies (Cromie et al., 2000; Shields et al., 2002a) but the number of participating departments (n = 46) was lower than reported by Shields et al. (2002a) although greater than reported by Martin et al. (1990).

Equipment issues

The decline in the use of microwave diathermy in the UK has been reported earlier (Wilton, 1994), but for the first time this study has reported that microwave diathermy was not available in the physiotherapy departments surveyed. Some departments did not use pulsed shortwave diathermy and continuous shortwave diathermy devices despite equipment availability (Shields et al., 2001), which could be attributed to concerns about clinical effectiveness and safety issues (Kitchen, 1995; Partridge and Kitchen, 1999; Grant, 2001; Shields et al., 2001; Laakso et al., 2002; Shields et al., 2002a). The

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reasons for non-use of these modalities were not requested in the present study and these should be investigated in future research.

In the UK, Standard 18 of the *Core Standards of Physiotherapy Practice* (CSP, 2005) addresses electrotherapy equipment and safety but does not specifically state a regular interval for calibration and safety checks. However, the Chartered Society of Physiotherapy (CSP) has strongly recommended maintenance of shortwave diathermy devices at regular intervals such as every six months (Docker et al., 1992, 1994). The frequency of maintenance for devices reported in the present study agrees with guidelines and previous research (Health Canada, 1983; Docker et al., 1992, 1994; Robertson et al., 2001; Shields et al., 2001; Bazin, 2002). However, a faulty pulsed shortwave diathermy device applicator was found in one department and subsequently validated with a fluorescent test tube; there was no written notice on the device or in the cubicle. As this practice may create health and safety problems, the tagging of faulty devices and leads is essential (Robertson et al., 2001; CSP, 2005). Although a timetable for calibration should exist for all electrotherapy devices there was no such timetable in any department.

The finding of electromagnetic interference by operating shortwave diathermy devices with other electrical equipment accords with previous studies (Valtonen et al., 1975; Jones, 1976; Wilton, 1994; Ruggera et al., 2003). The occurrence of electromagnetic interference, however, does not mean a higher electromagnetic field strength (McDowell and Lunt, 1991) but it can be a source of risk (Grant, 2001) to patients, physiotherapists and members of the public in physiotherapy departments who are wearing implants, for example cardiac pacemakers or defibrillators, and/or using electrical and electronic aids, such as hearing aids. Therefore mitigation of electromagnetic interference is essential (Wilton, 1994), which can be done by isolating shortwave diathermy devices (McDowell and Lunt, 1991) at a minimum distance of 3 m and, if possible, 5 m from other equipment (Docker et al., 1992, 1994; Belanger, 2002), by placing them in a different part of the building (Crevenna et al., 2003) or by shielding treatment cubicles and rooms (Dey et al., 1995; Robinson et al., 2003; Aniolczyk et al., 2004). Locating physiotherapy departments away from intensive care units, computer departments, offices, workstations and telephone exchanges has also been recommended (Wilton, 1994). Moreover, electromagnetic interference between shortwave diathermy and microwave diathermy devices is possible and these modalities should not be used simultaneously in the same cubicle (Veit and Bernhardt, 1984).

Treatment issues

The guidelines for occupational exposure to electromagnetic fields are based on exposure averaged over six minutes (ICNIRP, 1998; European Community, 2004; NRPB, 2004) and the total time operators spent inside the cubicle during shortwave diathermy treatment could not be assessed in the present study since this varied with practice and included physiotherapists leaving the cubicle.

Environmental issues

The size of treatment cubicles is important in reducing physiotherapists' exposure to stray electromagnetic fields from operating shortwave diathermy devices. Electromagnetic fields can pass through cloth curtains, windows, doors and the walls between

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cubicles (CSP, 1997a; Aniolczyk et al., 2004) and lead to undesirable exposure in adjacent cubicles, rooms and corridors (Grant, 2001; Grandolfo and Spinelli, 2002). Strategically placed departmental notices would ensure avoidance of stray electromagnetic field exposure when shortwave diathermy is operating (NHMRC, 1986b).

In some departments, shortwave diathermy electrotherapy treatment couches contained metal and there were large metallic objects near shortwave diathermy devices; these can disturb stray electromagnetic fields (Docker et al., 1992, 1994; Grandolfo and Spinelli, 2002; Hrnjak and Zivkoviae, 2002) and enhance electromagnetic field reflection (Grant, 2001) up to 100% (McMeeken and Stillman, 2002). This is therefore a source of health hazard (Docker et al., 1992; Shields et al., 2003b). Shortwave diathermy therapy should, therefore, always take place on a wooden treatment couch or chair (Health Canada, 1983; NHMRC, 1986b; Docker et al., 1992, 1994) with either no large metallic objects present in cubicles (Robertson et al., 2001) or, if present, these should be located at least 3 m away from operating shortwave diathermy devices, electrodes and cables (Health Canada, 1983).

Operator issues

Specific electrotherapy modalities should be used only by properly trained physiotherapists and following recommended clinical and safety guidelines (Stuchly et al., 1982; Health Canada, 1983; NHMRC, 1986a, 1986b; Delpizzo and Joyner, 1987; Martin et al., 1990; Docker et al., 1992, 1994; CSP, 1997a; Robertson et al., 2001; Grandolfo and Spinelli, 2002; CSP, 2005). The majority of the departments surveyed in the present study reported that physiotherapists were trained in the safe use of pulsed shortwave diathermy and continuous shortwave diathermy devices, but comments received suggest that in some departments there was a need for regular refresher courses every five years at least (Docker et al., 1992, 1994).

In 60% and 80% of departments where pulsed shortwave diathermy and continous shortwave diathermy, respectively, were used operators stayed at recommended distances of 1 m from the console of operating shortwave diathermy devices and at 0.5 m from the cables (Stuchly et al., 1982; Health Canada, 1983; NHMRC, 1986b; Martin et al., 1990; Docker et al., 1992, 1994; CSP, 1997a; Robertson et al., 2001) or at greater distances (Shields et al., 2004a) or left the treatment cubicle (Veit and Bernhardt, 1984). If the physiotherapist left the treatment cubicle, the patient was given instructions to use a bell to call for help in the event of any problem (Robertson et al., 2001). The practice of leaving cubicles may not necessarily be to avoid electromagnetic field exposure but may be to perform other duties.

The contraindications for using shortwave diathermy and microwave diathermy devices for patients are well documented (Paterson, 1940; Delpizzo and Joyner, 1987; Docker et al., 1992, 1994; Robertson et al., 2001; Belanger, 2002; McMeeken and Stillman, 2002; Shields et al., 2002b; Shields et al., 2004b; Electrotherapy.org, 2005). However, the contraindications for physiotherapists using diathermy devices are not clear. According to Scott (2002) the contraindications applicable to the patient apply equally to the physiotherapist. The use of shortwave diathermy devices by pregnant physiotherapists is subject to extra caution (Docker et al., 1992, 1994) and a systematic risk assessment (CSP, 1997a). The present study found pregnant physiotherapists reported not using pulsed shortwave

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diathermy and continuous shortwave diathermy devices. This might be attributed to compliance with guidelines (Docker et al., 1992, 1994; CSP, 1997a) or to physiotherapist's perception of potential risks, or both (Taskinen et al., 1990; Ouellet-Hellstrom and Stewart, 1993; Lerman et al., 2001; Belanger, 2002). Physiotherapy departments reported other conditions (see Table 4) as contraindications for physiotherapists using shortwave diathermy devices. Since the majority of the contraindications are based on good clinical judgement (Belanger, 2002), it is suggested that the relevant professional bodies review the clinical evidence and issue appropriate guidelines on contraindications for operator use.

Departmental issues

In physiotherapy departments, an electrotherapy audit can help in assessment of practices and procedures for the use of various modalities, distribution of workload, use or non-use of different devices and health and safety issues (Turner et al., 1999). It was found that electrotherapy audit was not a regular or common practice because it was not mandatory. Although an annual audit may help to evaluate practices and procedures (Turner et al., 1999), a risk assessment will be required if health and safety risks exist (HMSO, 1974, 1992; CSP, 1997b).

The finding of greater use of electrotherapy in the departments where there were fewer physiotherapists may be important with respect to exposure of physiotherapists to electromagnetic fields. The authors are not aware of any limit to the number of patients treated with electrotherapy by a physiotherapist in one day. If there are any professional guidelines in this regard, physiotherapy managers and superintendents should ensure compliance with them. However, if no such guidelines exist, the professional bodies and those responsible for occupational health and safety should undertake their development.

CONCLUSIONS

The practices and procedures adopted in the use of therapeutic diathermy varied between departments and, in general, there were good safety practices and procedures. However, careful investigation of departmental practices and procedures and the work setting can identify factors that give rise to occupational health and safety issues. Ensuring the health and safety of working staff and other people in physiotherapy departments may require further hazard identification, assessment and mitigation of source(s) of concern.

Future research to investigate physiotherapists' perception of risk with respect to their daily working environment and the measurement of any stray electromagnetic field emission from shortwave diathermy devices should highlight the level of health and safety risk for the tens of thousands of practising physiotherapists in the UK.

IMPLICATIONS

The present study highlighted practices and procedures presently adopted in NHS physiotherapy departments during the use of therapeutic diathermy. The issues raised in the study should enable physiotherapists' professional bodies and regulatory authorities to further evaluate health and safety guidelines for electrotherapy with diathermy to ensure physiotherapists' health and safety at work.

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