Standing with assistance of a tilt table in intensive care: A survey of Australian physiotherapy practice

Angela T Chang¹, Robert Boots², Paul W Hodges¹ and Jennifer Paratz³

¹School of Physiotherapy, University of Queensland  ²Intensive Care Facility, Royal Brisbane Hospital  ³Department of Physiotherapy, La Trobe University

Introduction

Standing with assistance of the tilt table is recommended to reintroduce patients to the vertical position when they are unable to stand or mobilise safely even with considerable assistance (Webber and Pryor 1993). Use of the tilt table in intensive care to assist patients into standing has been encouraged as a technique to minimise the adverse effects of prolonged immobilisation (Webber and Pryor 1993), such as orthostatic hypotension, reduced oxygen consumption, venous pooling, reduced lung volumes, impaired gas exchange, muscle atrophy, joint contractures, peripheral nerve injuries, and pressure areas (Szafleskar 1993). Early rehabilitation including tilting is also recommended for chronically critically ill patients to improve functional outcome following discharge from intensive care (Thomas et al 2002).

Although use of tilt tables is recommended in clinical practice, the benefits have been evaluated in only one case report (Dean and Ross 1992). Despite the lack of clinical trials, tilting was included as a treatment modality in the recent statement by British physiotherapists working in critical care (AHP and HCS Advisory Group 2002). The hypothesised benefits of tilting include increased ventilation, increased arousal, improved weight bearing of the lower limbs, and facilitation of antigravity exercise of the limbs (Dean and Ross 1992). Studies in healthy subjects have demonstrated that passive tilting improves minute ventilation and tidal volume as well as improving functional residual capacity (Chadha et al 1985, Davies et al 1980, Loepky and Luft 1975). However, it is unknown whether these changes also occur in intensive care patients following tilting.

There is no quantitative evidence available regarding tilt table use within intensive care units (ICUs) of Australian hospitals. The purpose of this study was to investigate the frequency of use and clinical decisions associated with incorporation of tilt table into management of patients in ICUs across Australia.

Method

Questionnaire development A closed response questionnaire regarding the practice of standing with assistance of a tilt table, mobilisation, and positioning was drafted following focus group discussions with physiotherapists currently working in two metropolitan ICUs in Brisbane. The final format of the questionnaire was completed by physiotherapists working in a third hospital in Brisbane, who had not been involved in the development of the questionnaire, and by physiotherapists working in a Victorian ICU; revisions were made. The areas covered by the questionnaire included frequency of use of mobilisation, positioning and tilting, physiotherapy experience, and ICU level (Table 1). Further information sought regarding tilting included indications, contraindications, safety measures taken, duration of treatment, and outcome measures used.

Data collection All Australian public adult hospitals with intensive care facilities that responded to the Australia and New Zealand Intensive Care Society survey in 1998 (Anderson and Hart 2000), which had a response rate of 99.4%, were contacted by mail. In each institution, the head of the physiotherapy department was requested to ask the senior physiotherapist working in the intensive care unit to complete the questionnaire. This study was approved by the institutional ethics committee and informed consent was provided by all participants.

Data analysis 2 x 2 chi-squared tests were used to determine the relationship between tilt table use and ICU level, mobilisation,
and positioning practices. The relationship between physiotherapy experience and selection of contraindications was also analysed with chi-squared tests. For all analyses the significance level was set at 0.05.

**Results**

Eighty-six of 99 Australian adult public hospitals with an intensive care unit returned the survey (86.9% response rate.) Respondents comprised 37 physiotherapists (43%), 44 senior physiotherapists (51.2%) and 5 directors of physiotherapy services (5.8%). The mean (SD) length of physiotherapy experience was 11.9 (8.8) years with 4.4 (4.4) years of ICU experience. The ICUs had a mean of 9.6 (5.4) beds. There were 41 Level 3 (47.7%), 25 Level 2 units (29.1%), and 20 Level 1 (23.3%) units.

**Positioning and mobilisation in ICU** Fifty-eight respondents (67.4%) used standing with assistance of the tilt table. Other mobilisation techniques were used more frequently, with all respondents incorporating practice of sit-to-stand and walking on the spot. Mobilising with manual assistance (85 respondents, 98.8%) and wheeled walking frame (84 respondents, 97.6%) were common; use of exercise bicycles (18 respondents, 20.9%) and treadmill walking (3 respondents, 3.5%) were less common.

Physiotherapists also used positioning techniques in their management of patients in ICU. These included: sitting out of bed and high sitting (100% of respondents), side-lying (85 respondents, 98.8%), postural drainage positions (84 respondents, 97.6%) and quarter turns (80 respondents, 93%). Some less frequently used positioning techniques included prone positioning (68 respondents, 79.1%) and head-down tilt (67 respondents, 77.9%).

**Tilt table use in ICU** Of those respondents who included the tilt table in their management of ICU patients, 12 respondents (21%) reported tilting a new patient more than once a week, 10 (17.5%) used it less than once a week, 24 (40.3%) used tilting less than once per month, and the remaining 12 (21%) less than once a year (Table 2).

The most common reason reported for not using the tilt table (28 respondents, 32.5% of physiotherapists surveyed) was the judgment that it was not clinically indicated (16 respondents, 57% of those who do not tilt). Other reasons included a preference for other techniques (13 respondents, 46.4%), or a lack of time (5 respondents, 17.9%). In 39% of the non-users (11 respondents) no equipment was available.

The common clinical presentations in which tilting was used as a component of treatment included: neurological conditions (37 respondents, 63.8% of those who tilt), multiple organ failure (28 respondents, 48.3%) and long term ICU stay patients (25 respondents, 43.1%), acute respiratory distress syndrome (21 respondents, 36.2%), trauma (20 respondents, 34.5%), pneumonia (18 respondents, 31%), abdominal surgery (17 respondents, 29.3%), and chronic obstructive airways disease (16 respondents, 27.5%). Therapists most commonly tilt 0–5 new patients per month (55 respondents, 94.8% of those who tilt), where the median length of initial tilt table treatment duration was 10 minutes at an initial angle of 45 degrees from the horizontal.

Factors that influenced the angle of the tilt table included patient’s cardiovascular stability (57 respondents, 98.3% of those who tilt), patient anxiety (52 respondents, 89.7%), pain (51 respondents, 87.9%), and comfort (49 respondents, 84.5%). Similarly, factors influencing the duration of the tilt table treatment included cardiovascular stability (57 respondents, 98.3%), patient fatigue (54 respondents, 93.1%), patient comfort (45 respondents, 77.6%) and respiratory pattern (45 respondents, 77.6%).

The reasons physiotherapists included standing on the tilt table as part of physiotherapy treatment were to: facilitate weight bearing (55 respondents, 94.8% of those who tilt), prevent contracture formation (50 respondents, 86.2%), improve lower limb muscle strength (47 respondents, 81.0%), increase arousal (40 respondents, 70.0%), re-educate muscle (39 respondents, 67.2%), reduce tone (38 respondents, 65.5%), and prevent muscle atrophy (33 respondents, 56.9%). Some less common reasons were to: prevent bone resorption (28 respondents, 48.3% of those who tilt), facilitate weaning (25 respondents, 43.1%), provide pressure area care (24 respondents, 41.4%), increase oxygenation (24 respondents, 41.4%), improve alveolar ventilation (23 respondents, 39.7%), and improve minute ventilation (19 respondents, 32.8%).

There was consensus regarding some contraindications to tilt table treatment, with the large majority of respondents stating they would not tilt patients with spinal injury (51 respondents, 87.9% of those who tilt), sepsis without fluid resuscitation (44 respondents, 75.9%), bilateral lower limb fractures (39 respondents, 67.2%), patients with more than one ventricular ectopic beat in five (38 respondents, 65.5%) or patients with unstable blood pressure (38 respondents, 65.5%). In some clinical presentations the respondents were divided equally whether to tilt, such as in the presence of inotropic medications (33 respondents, 56.9% of those who tilt), less than five days

<table>
<thead>
<tr>
<th>Level</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 3</td>
<td>Must be capable of providing complex, multisystem life support for an indefinite period; must be a tertiary referral centre for patients in need of intensive care services and have extensive backup laboratory and clinical service facilities to support the tertiary referral role. It must be capable of providing mechanical ventilation, extracorporeal renal support services and invasive cardiovascular monitoring for an indefinite period; or care of a similar nature.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Must be capable of providing complex, multisystem life support and be capable of providing mechanical ventilation, extracorporeal renal support services and invasive cardiac monitoring for a period of at least several days, or longer periods in remote areas; or care of a similar nature.</td>
</tr>
<tr>
<td>Level 1</td>
<td>Must be capable of providing basic multisystem life support usually for less than a 24 hour period. It must be capable of providing mechanical ventilation and simple invasive cardiovascular monitoring for a period of at least several hours; or care of a similar nature.</td>
</tr>
</tbody>
</table>

*From the Australian Institute of Health and Welfare guidelines (1999)
following skin grafting for burns (29 respondents, 50%), the presence of a pulmonary artery catheter (25 respondents, 43.1%), and intracranial pressure monitoring (27 respondents, 46.6%). Clinical presentations that were not seen as contraindications to tilting included: unilateral lower limb fractures less than six weeks post injury (18 respondents, 31% of those who tilt), patients requiring physical restraints (18 respondents, 31%) and burns patients before skin grafting (16 respondents, 27.6%). When the selection of contraindications was compared with physiotherapy experience, that is senior or non-senior physiotherapists, no significant differences in the decision to commence tilting was demonstrated ($p > 0.05$, data not shown).

All respondents combined tilt table treatment with other physiotherapy techniques. These included: upper limb demand ventilation (54 respondents, 93.1% of those who tilt), breathing exercises (50 respondents, 86.2%), balance and head control activities (49 respondents, 84.5%), lower limb exercises (46 respondents, 79.3%), passive stretches (45 respondents, 77.6%), and suction (36 respondents, 62.1%). Safety parameters monitored during the tilt table treatment included blood pressure (57 respondents, 98.3% of those who tilt), heart rate (55 respondents, 94.8%), and oxygen saturation (54 respondents, 93.1%). On completion of the tilt, outcome measures to determine the effectiveness of the treatment included: progression of tilt angle (55 respondents, 94.8% of those who tilt), progression of tilt duration (55 respondents, 94.8%), range of movement (37 respondents, 63.8%), and level of consciousness (36 respondents, 62.1%). A significant difference was noted in tilt table practice depending on the level of ICU ($\chi^2_{12} = 32.47$, $p = 0.001$). When the ICU level and tilt table practice are compared, there is a trend towards more frequent tilt table use in higher levels of ICU (Table 2).

In contrast, no significant relationships were demonstrated between tilt table practice and use of positioning or mobilisation techniques ($p > 0.05$, data not shown).

### Discussion

Early rehabilitation of patients in intensive care is a common focus of physiotherapy practice and includes techniques of mobilisation, positioning, and standing with assistance of a tilt table (Griffiths and Jones 1999, Thomas et al 2002). All Australian physiotherapists working in ICU included mobilising on the spot and practice of sit-to-stand in patient management. This is similar to European practice (Norrenberg and Vincent 2000). However, in the European study, only 22% of survey forms were returned, limiting the validity of these findings. In contrast, only 56.3% of Canadian physiotherapists mobilised intubated and ventilated patients in ICU (King and Crowe 1998).

As the current study did not specify whether the patients mobilised were intubated or ventilated, international comparison of the use of mobilisation is difficult.

Positioning is also used widely by Australian ICU physiotherapists. All respondents incorporated high sitting and sitting out of bed as part of patient management. This is in agreement with a survey of Canadian physiotherapists, who all used positioning of patients in bed and sitting out into a chair as part of physiotherapy treatment (King and Crowe 1998).

Despite the reported inclusion of standing with assistance of the tilt table as part of the physiotherapy intervention for patients in intensive care (AHP and HCS Advisory Group 2002, Webber and Pryor 1993) and its role in early rehabilitation (Thomas et al 2002), this is the first study to quantify tilt table practice in the intensive care unit.

### Inclusion of tilt table treatment

The majority (67.4%) of physiotherapists working in ICU include tilt table treatment in their management of patients. However, tilt table treatment is not used as widely as are techniques of mobilisation and positioning. This may be influenced by the type of patient who would be tilted rather than mobilised. (Very weak and debilitated patients may not be mobilised safely even with assistance, but might benefit from exercise and positioning into the vertical position using a tilt table as part of early rehabilitation.)

Common clinical conditions in which the respondents applied tilting included neurological conditions and prolonged ICU admissions. Recently, weakness syndromes in prolonged critical illness have been recognised with incidence of critical illness polyneuropathy up to 84% in patients admitted to ICU for greater than seven days (Coakley et al 1998). Standing with assistance of a tilt table may have a role in the management of these patients to progress towards mobilisation.

In high level ICUs a greater proportion of physiotherapists included tilting as part of treatment. Level 1 and 2 ICUs are unlikely to have long-term admissions requiring rehabilitation as patients are generally admitted for only a few days for respiratory, renal, or cardiac monitoring and support (Australian Institute of Health and Welfare 1999). Tilt table treatment was included as part of physiotherapy management in 36 out of 41 Level 3 units across Australia (87.8%), compared to 67.4% in all levels.

Although the median tilt table treatment starts at 45 degrees from the horizontal, each treatment was individualised to the patient. Over 85% of respondents noted that patient responses to the intervention, such as fatigue, cardiovascular stability, comfort and respiratory pattern, influenced the duration and angle of treatment. Patients were monitored continuously and treatment was modified with any changes in the above parameters. The most consistent assessments of treatment effectiveness were progression of tilt angle and duration, suggesting that tilt table treatment is used in a progressive manner, with repeated interventions adapted to improvements in the patient’s condition.

### Perceived benefits of tilt table treatment

The main reasons for tilting were for its musculoskeletal benefits and to increase arousal. The reported outcome measures complemented the

<table>
<thead>
<tr>
<th>ICU level</th>
<th>&gt; 1/week</th>
<th>&lt; 1/week</th>
<th>&lt; 1/month</th>
<th>&lt; 1/year</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>0 (0%)</td>
<td>1 (5%)</td>
<td>4 (20%)</td>
<td>3 (15%)</td>
<td>12 (60%)</td>
</tr>
<tr>
<td>Level 2</td>
<td>2 (8%)</td>
<td>0 (0%)</td>
<td>8 (32%)</td>
<td>5 (20%)</td>
<td>11 (40%)</td>
</tr>
<tr>
<td>Level 3</td>
<td>10 (27%)</td>
<td>9 (20%)</td>
<td>12 (29%)</td>
<td>4 (10%)</td>
<td>6 (14%)</td>
</tr>
</tbody>
</table>

*Percentages are % of units at that level.*
perceived benefits, as range of motion (63.8%), muscle strength (58.6%) and level of consciousness (62.1%) were used to monitor the effectiveness of treatment. Similarly, lower limb exercises (79.3%), passive stretches (77.6%) and balance work (82.8%) were included as adjuncts to treatment.

Changes in ventilation with tilt table treatment were not perceived to be as significant as musculoskeletal benefits. This may result from a lack of objective evidence of ventilatory changes (Dean and Ross 1992, Wong 1999). However, recently we have demonstrated improved minute ventilation following a 5-minute tilt intervention in intensive care patients (Chang et al 2003). Interestingly, the most commonly used adjunct treatment techniques with tilt table treatment are upper limb demand ventilation (93.1%) and breathing exercises (86.2%). This indicates that the tilt table treatment, although not perceived to improve ventilation alone, is combined with treatment modalities known to improve ventilation (Petta et al 1998).

**Contraindications and safety issues** There are no published guidelines regarding contraindications for tilt table use. Although it is beyond the scope of this questionnaire to determine which clinical presentations should be contraindications to tilting, the survey demonstrated some agreement regarding the contraindications used by physiotherapists in Australia. The majority of respondents (over 60%) would not tilt patients with spinal injury, sepsis without fluid resuscitation, bilateral lower limb fractures, more than one ventricular ectopic beat in five, or labile blood pressure. Less agreement was seen with regard to inotropic drug use, the presence of pulmonary artery catheter, or intracranial monitoring. Although monitoring may indicate compromise of cardiovascular and neurological systems (Hanley 1997, Myburgh and Runciman 1997), it is beyond the scope of this study to determine whether tilting should not be undertaken in such patients.

**Conclusion**

Standing with assistance of a tilt table is used by the majority of physiotherapists in the management of intensive care patients. The inclusion of tilt table treatment into physiotherapy practice is greatest in Level 3 intensive care units. The main perceived benefits of the intervention are improved musculoskeletal function and increased arousal. However some disparity is present regarding the contraindications to tilt table treatment. Guidelines are needed to standardise the practice of tilting intervention to optimise patient safety and overall outcome.

**Acknowledgements** Financial support was received from the Dorothy Hopkins Award for Clinical Study from the Australian Physiotherapy Association, Queensland Branch.

**Correspondence** Ms Angela T Chang, School of Physiotherapy, University of Queensland, Queensland 4072.

Email: a.chang@shrs.uq.edu.au

## References


Davies A, Sant’Ambrogio FB and Sant’ Ambrogio G (1980): Control of postural changes of end expiratory volume (FRC) by airways slowly adapting mechanoreceptors. Respiration Physiology 41: 211–216.


