Acoustic Pressure Wound Therapy in the Treatment of Stage II Pressure Ulcers

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Pressure ulcers are localized skin injuries secondary to unrelieved pressure or friction. Patients with immobility issues are at increased risk for developing pressure ulcers. In 2004, stricter federal regulations for prevention and treatment of pressure ulcers in institutional settings — eg, long-term care facilities — were introduced. Effective, low-cost treatments for pressure ulcers are needed; acoustic pressure wound therapy (APWT), a noncontact, low-frequency, therapeutic ultrasound system, is one option. A retrospective case series of six long-term care patients (two men and one woman, age range 61 to 92 years), each with one Stage II pressure ulcer, is presented. Acoustic pressure wound therapy was provided as an adjunct to standard treatment that included balsam of Peru/castor oil/trypsin ointment, hydrogel, hydrocolloid dressings, silver dressings, and offloading. Outcomes (days to healing) were determined through changes in wound dimensions. Study participants each received APWT for 3 to 4 minutes three to four times weekly. In four of the six wounds, the average number of days to healing was 22. One of the two remaining patients discontinued treatment at 95% healed; treatment for the sixth patient was ongoing due to hospitalization that delayed APWT. In a long-term care setting, APWT added to standard of care may accelerate healing of Stage II pressure ulcers.

KEYWORDS: acoustic pressure wound therapy; pressure ulcer; wounds

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Pressure ulcers (PU) are localized skin injuries, typically over a bony prominence, that develop as the result of unrelieved pressure, friction, or shear. They range from intact reddened skin (Stage I) to exposed bone (Stage IV). Pressure ulcers can become chronic, debilitating, painful, and life-threatening. They are a common problem in patients with reduced mobility. Patients in long-term care (LTC) facilities are at an increased risk of developing PUs. In the nursing home setting, the median time to heal a Stage II PU has been found to be 46 days. In 2004, stricter federal guidelines for the prevention and treatment of PUs in LTC facilities were instituted; increasing the economic burden of PUs in this setting.

Acoustic pressure wound therapy (APWT; MIST® Therapy System; Celleration, Eden Prairie, Minn) is a noncontact, low-frequency, nonthermal ultrasound therapy delivered via sterile, saline mist. The acoustic energy stimulates wound healing at the cellular level and cleanses and debrides wounds. A growing body of

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clinical literature has described the effectiveness of APWT in studies of acute and chronic wounds. Some clinical evidence also suggests that APWT reduces wound-related pain and in vitro data found that APWT destroys bacterial cells. Because of increasingly stricter federal regulations for PUs, the author’s LTC facility recently added APWT to standard of care for Stage II PUs. This six-patient case series describes the outcomes of APWT in the treatment of Stage II PUs in LTC residents with impaired mobility.

**Methods**

Data were collected retrospectively from the medical records of six nonconsecutive patients. This is a representative sample of patients with Stage II pressure ulcers treated with APWT and standard of care at this LTC facility. Patients or their legal guardians provided informed consent for treatment and inclusion in this case series. Patients were treated with APWT as an adjunct to standard wound care that included balsam of Peru/castor oil/trypsin ointment, hydrogel, hydrocolloid dressings, and silver sulfadiazine. Patients were also treated with mattresses and wheelchair cushions to provide offload-relieving devices such as mattresses and wheelchair cushions to provide offload-relieving devices. The effect of APWT was noted on wound healing.

**TABLE 1**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Gender/Race</th>
<th>Age (year)</th>
<th>Medical history</th>
<th>Wound location</th>
<th>Wound area cm² Pre-APWT</th>
<th>Wound area cm² Post-APWT</th>
<th>Number of APWT treatments</th>
<th>Days to healing with APWT + SOC</th>
<th>Days to healing with SOC alone based on wound size</th>
<th>Median days to healing with SOC alone based on wound size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female/Caucasian</td>
<td>89</td>
<td>Alzheimer’s disease; hypertension; Parkinson’s Disease; hemiplegic; gunshot wound; morbid obesity; neuropathy</td>
<td>Right, ischial tuberosity</td>
<td>5.22</td>
<td>0.00</td>
<td>12</td>
<td>28</td>
<td>73 were ongoing</td>
<td>Discontinued</td>
</tr>
<tr>
<td>2</td>
<td>Female/African American</td>
<td>61</td>
<td>Alzheimer’s disease; osteoporosis</td>
<td>Right ischium</td>
<td>1.56</td>
<td>0.00</td>
<td>12</td>
<td>28</td>
<td>53 were ongoing</td>
<td>Discontinued</td>
</tr>
<tr>
<td>3</td>
<td>Female/Caucasian</td>
<td>89</td>
<td>Alzheimer’s disease; osteoporosis</td>
<td>Coccyx</td>
<td>0.21</td>
<td>0.00</td>
<td>13</td>
<td>24</td>
<td>33 were ongoing</td>
<td>Discontinued</td>
</tr>
<tr>
<td>4</td>
<td>Male/Caucasian</td>
<td>75</td>
<td>Parkinson’s Disease; diabetes mellitus; hypertension; atherosclerosis; anemia; cholecystitis</td>
<td>Coccyx</td>
<td>0.44</td>
<td>5.16</td>
<td>Ongoing</td>
<td>Ongoing</td>
<td>n/a were ongoing</td>
<td>Discontinued</td>
</tr>
<tr>
<td>5</td>
<td>Female/Caucasian</td>
<td>92</td>
<td>Diabetes mellitus; hypertension;</td>
<td>Mid-back</td>
<td>0.25</td>
<td>0.00</td>
<td>5</td>
<td>9</td>
<td>33 were ongoing</td>
<td>Discontinued</td>
</tr>
<tr>
<td>6</td>
<td>Male/Caucasian</td>
<td>83</td>
<td>Atrial fibrillation; paralysis agitation; status post hip fracture; restless leg syndrome; recurrent knee infection; anemia; depression</td>
<td>Right distal calf</td>
<td>5.58</td>
<td>0.28</td>
<td>37</td>
<td>Discontinued</td>
<td>73 were ongoing</td>
<td>Discontinued</td>
</tr>
</tbody>
</table>

APWT = acoustic pressure wound therapy  n/a = not applicable  SOC = standard of care
a. Wound worsened when APWT was interrupted twice due to hospitalization; however, 2 weeks following second hospitalization and APWT resumption, wound area decreased 79%.  b. APWT was discontinued when the wound was 95% healed. The wound healed completely <1 month later.
assessed through changes in wound dimensions. The author manually abstracted and analyzed data from patient charts.

Results
Study participants included six patients (two men and four women, age range 61 to 92 years), each with one Stage II PU located over the pelvic bone or coccyx or on the back or lower extremity. All patients were LTC residents with various comorbidities and severely restricted mobility (see Table 1).

Patients received three to four APWT treatments of 3 to 4 minutes weekly for an average of 4 weeks (see Table 1). Three weeks after wound onset and APWT initiation, one wound completely healed and the surface area of four of the six wounds decreased 46% to 81%. After five to 13 APWT treatments, four of the six wounds were healed (see Table 1). The average time to healing was 22 days. One patient stopped APWT after 37 treatments when the wound area was reduced by 95%; this wound completely healed within a few weeks of APWT discontinuation.

Treatment continued for another patient who suffered a relapse due, in part, to hospitalizations that interrupted his APWT treatments. During hospitalization, the wound area increased by 85%; however, in the 2 weeks following a second hospitalization and resumption of APWT, the wound area decreased by 79%.

Discussion
Under stricter federal guidelines and enforcement, LTC facilities have increased their vigilance regarding the prevention and treatment of PUs. Treatment guidelines for PUs have remained essentially unchanged over the past decade; novel, low-cost treatments that prevent worsening and encourage healing of Stage II PUs are needed. Therefore, healing rates of standard treatment as found in the literature were compared to APWT used as an adjunct to standard treatment. The median rate to heal a small PU (1 cm² or less) is 33 days; two small PUs with an average size of 0.23 cm² in this case series healed in 9 and 24 days, respectively. The median rate for a medium-sized PU (1 cm² to 4 cm²) has been reported at 53 days; the medium-sized PU in this case series healed in 28 days. Large PUs (>4 cm²) are reported to heal in 28 days. When prevention efforts fail, as they sometimes do, healing PUs before they progress to Stage III is essential for both the patient and the LTC facility.

In addition to regulatory and reimbursement demands, PUs exact a heavy economic burden. In 1999, US hospitals spent an estimated $2.2 to $3.6 billion in the treatment of 16 million PUs. Treatment costs for Stage III or Stage IV PUs were between $14,000 and $23,000 each. Some ulcers never heal and require surgery to close. Implementing therapies that can decrease time to healing and subsequently decrease cost are much needed.

Conclusion
In a retrospective case series of six LTC patients, APWT as an adjunct to standard of care was shown to result in accelerated healing of Stage II PUs. When prevention efforts fail to eliminate PUs, strategies to thwart escalation into higher stages, as well as to facilitate healing, need implementation. Further study to this end is warranted.

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References