Acoustic Pressure Wound Therapy for Management of Mixed Partial- and Full-Thickness Burns in a Rural Wound Center

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Infection, pain, and cosmetically unacceptable scarring frequently complicate full-thickness burns. Outpatient management can be difficult without specialized care. A retrospective case series study was conducted in a rural wound center lacking specialized burn care to assess the clinical effectiveness of acoustic pressure wound therapy, a noncontact low-frequency, nonthermal ultrasound wound therapy that accelerates healing through positive pressure, stimulating fibroblasts, clearing bacteria and debris, and relieving pain. Data from the records of 14 consecutively treated outpatients (age range 5 months to 78 years old) with mixed partial- and full-thickness burns involving the trunk, extremities, or both, averaging 7% of body surface area (range: 1% to 24%), were reviewed. Patients received acoustic pressure wound therapy with standard burn care. Burn thickness was determined by clinical appearance. Treatment effectiveness was evaluated based on scarring characteristics of healed wounds (ie, cosmetic appearance) and pain resolution. Pain was patient-rated using a 10-point visual analog scale (0 = no pain, 10 = severe). Patients were followed for 6 months post-healing. Pain improved with therapy (range: two to 10 treatments). No patient required hospitalization or developed complications related to infection. Pliable, nonhypertrophic scars developed in 86% of patients and hypertrophic scars developed in 14%. Repigmentation was seen in 79% of patients, with only minor irregularities; hypopigmentation occurred in 21%. Scars available for follow-up (71%) remained unchanged. Acoustic pressure wound therapy with standard burn care was found to heal mixed partial- and full-thickness burns and reduced pain in outpatients, resulting in cosmetically acceptable scarring without infectious complications, surgery, or skin grafts and may prove beneficial for inpatient management of extensive full-thickness burns. Further study is warranted.

KEYWORDS: acoustic pressure wound therapy, debridement, noncontact ultrasound, outpatient burn care, wounds

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Surgery and skin grafts are usually required for full-thickness burns.

Burn treatment varies according to type, depth, and extent of injury. Standard burn treatment includes daily cleansing, debridement, application of topical antimicrobials, nonadherent dressings, and pain management.

Acoustic pressure wound therapy (APWT; MIST Therapy System [Celleration, Eden Prairie, Minn.]), is a noncontact, low-frequency, nonthermal ultrasound treatment utilizing positive pressure to accelerate healing, cleanse, and debride. In APWT, ultrasound waves delivered via sterile saline mist stimulate fibroblasts to accelerate healing and remove bacteria from the wound bed. The effectiveness of APWT has been demonstrated in acute and chronic wounds, including burns, and has been associated with reductions in wound-related pain.

This retrospective case series study was conducted to assess the clinical effectiveness of APWT in treating mixed partial- and full-thickness burns in a rural wound care center lacking specialized burn care.

Methods

Data were manually extracted from the charts of 14 consecutively treated outpatients with mixed partial- and full-thickness burns who received APWT with standard burn care from August 2006 to October 2007. Data included demographic characteristics (age, sex, and ethnicity), medical histories, burn data (date of burn, type, severity, dimensions, and percent body surface area affected), total number of APWT treatments necessary for complete healing, pre- and post treatment pain scores, and the number of APWT treatments necessary to decrease pain. Burn thickness was assessed by clinical appearance. Burns were classified as full-thickness if eschar was present and no blanching was evident with pressure. All burns had areas of partial-thickness. Treatment continued until burns were healed. Patients were followed for up to 6 months.

Outcome effectiveness of APWT was evaluated based on scarring characteristics (ie, cosmetic appearance) of healed wounds and pain resolution. The authors determined scarring characteristics by visual inspection. Patients rated pain using a 10-point visual analog scale (VAS; 0 = no pain, 10 = severe pain) before each APWT treatment.

Summary of Cases

Patients were 5 months to 78 years old. Seven patients (50%) had medical histories significant for diabetes or cardiovascular disease (see Table 1). Most (13 out of 14) burns were thermal; one was chemical. Burns were located on extremities, trunk, or both. The average body surface area affected was 7% (range: 1% to 24%). Most patients (71%) experienced pre-treatment burn-related pain (VAS 2 to 10).

Patients received between two and 108 APWT treatments, depending on their rate of healing (see Table 1).
Topical treatments included antimicrobials (eg, silver sulfadiazine 1% and hydrofiber with silver) and petroleum gauze dressings; one patient received enzymatic debridement and whirlpool treatments (pre-APWT).

Pain resolved within one and 10 APWT treatments. No hospitalizations or burn infections occurred. Pliable, nonhypertrophic (ie, flat) scars developed in 86% of patients (see Figure 1a–c). Repigmentation developed in 79% of patients, with cosmetically acceptable appearance in 71%. All burns healed between 1 week and 45 weeks.

Follow-up data were available for 71% of patients; nine at 6 months and one at 3.5 months (this patient died of unrelated causes before the 6-month follow-up). Initial scar assessments (see Table 1) were unchanged at follow-up. Four patients were lost to follow-up.

**Conclusion**

The effectiveness of APWT in outpatient care for mixed partial- and full-thickness burns was demonstrated in 14 patients through cosmetically acceptable scarring (ie, predominantly pliable, nonhypertrophic scars and repigmentation) and pain reduction. No patient developed infectious complications. Initial scar assessments were maintained through follow-up. As this was not intended as a comparative trial, no comparison to treatment without APWT is possible nor is literature available as a historic control in a similar population.

The mixed partial- and full-thickness burns in this retrospective study healed without surgery or skin grafts typical for serious and extensive burns. Based on the results of this limited case series, studies of APWT as an adjunct to standard therapies for inpatient burn management are warranted.

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**References**

### TABLE 1

**DEMOGRAPHIC CHARACTERISTICS AND OUTCOMES OF PATIENTS WITH PARTIAL- AND FULL-THICKNESS BURNS TREATED WITH APWT**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Medical History</th>
<th>Burn Type</th>
<th>% BSA</th>
<th>APWT treatments, n</th>
<th>Pretreatment</th>
<th>Post-treatment/ #</th>
<th>Healing time, weeks</th>
<th>Scarring</th>
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<tr>
<td>1</td>
<td>48 y</td>
<td>DM, HTN</td>
<td>C</td>
<td>4</td>
<td>38</td>
<td>5</td>
<td>0/0</td>
<td>14.5</td>
<td>Nonhypertrophic, Hypopigmented</td>
</tr>
<tr>
<td>2</td>
<td>41 y</td>
<td>None</td>
<td>T</td>
<td>2</td>
<td>48</td>
<td>6</td>
<td>4/ -</td>
<td>16.5</td>
<td>Nonhypertrophic, Hypopigmented</td>
</tr>
<tr>
<td>3</td>
<td>54 y</td>
<td>DM, CABG</td>
<td>T</td>
<td>1</td>
<td>13</td>
<td>8</td>
<td>0/1</td>
<td>10</td>
<td>Slightly Hypertrophic, Pigment irregular</td>
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<tr>
<td>4</td>
<td>78 y</td>
<td>DM, HTN</td>
<td>T</td>
<td>24</td>
<td>31</td>
<td>7</td>
<td>0/3</td>
<td>10</td>
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<tr>
<td>5</td>
<td>19 y</td>
<td>None</td>
<td>T</td>
<td>16</td>
<td>4</td>
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<tr>
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<td>45 y</td>
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<td>T</td>
<td>10</td>
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<td>10</td>
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<td>4</td>
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<tr>
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<td>54 y</td>
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<td>T</td>
<td>9</td>
<td>108</td>
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<td>0</td>
<td>45</td>
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<tr>
<td>9</td>
<td>5 mo</td>
<td>None</td>
<td>T</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>0/2</td>
<td>7</td>
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<tr>
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<td>T</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>&lt;1</td>
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<tr>
<td>11</td>
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<td>DM, ESRD, HTN Neuropathy, CHF, TIA</td>
<td>T</td>
<td>2</td>
<td>15</td>
<td>0</td>
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<tr>
<td>12</td>
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<td>T</td>
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<td>10</td>
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<tr>
<td>13</td>
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<td>9 y</td>
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<td>9</td>
<td>3</td>
<td>0/2</td>
<td>3.5</td>
<td>Hypertrophic, Pigment irregular</td>
</tr>
</tbody>
</table>

* Pain continued beyond healing. † Treatment ≤3 times/week

APWT = acoustic pressure wound therapy; BSA = body surface area; C = chemical; CABG = cardiac artery bypass graft; CAD = cardiac artery disease; CHF = congestive heart failure; DM = diabetes mellitus; ESRD = end stage renal disease; HTN = hypertension; mo = month; PVD = peripheral vascular disease; T = thermal; TIA = transient ischemic attack; tx = treatment; VAS = visual analog scale; y = year