Incidence of Blockage Alarms when Dressing Connector Orifices are Blocked: Comparison of Negative Pressure Wound Therapy Systems

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Introduction
- There is an ongoing need to understand the differences among various negative pressure wound therapy (NPWT) offerings in the market space.
- Some NPWT system design elements may inappropriately preclude the triggering of blockage alarms, particularly if the NPWT systems do not have wound pressure regulating technology (PRT).
- Blockage alarms are important in notifying the user when prescribed NPWT is not being delivered.

Purpose
- The objective of these two laboratory studies was to evaluate the ability of NPWT brands with and without PRT to trigger blockage alarms when orifices in dressing connectors were blocked.

Methods
Study 1
- Three units of each of 3 NPWT systems with PRT (NPWT-A, NPWT-B, and NPWT-C; see Figures 3 and 4) were each tested with 3 respective dressings (n=9 runs/group).
- Testing was conducted without head height, with the simulated wound with dressings and associated therapy units were level, that is, with no vertical distance between them.

Study 2
- Three units of each of 4 NPWT systems with PRT (NPWT-A, NPWT-B, NPWT-C, NPWT-D; see Figures 5 and 6) were each tested with 3 respective dressings (n=9 runs/group).
- Testing was conducted without head height.

Methods (Cont.)
- The therapy system was connected to the respective dressings and pressure was measured independently at the dressing and the canister (see Figure 8) under the following 3 conditions:
  - No induced blockages.
  - Blockage induced in tubing near the canister (location 2).
  - Blockage induced at dressing connector orifice (location 1).

- Blockages were confirmed by pressure measurements at the dressing.
- When no blockages were present, no alarms were triggered in any of the groups.
- Fisher Exact test was used to statistically analyze blockage alarm incidences and a Wilcoxon Signed Rank test was used to analyze differences from target negative pressure (NP).
- Blockages were confirmed by pressure measurements at the dressing.
- When blockages at either site were present:
  - Canister NP associated with NPWT systems with PRT were greater than set NP, as a result of the PRT attempting to resolve low wound/dressing NP.
  - Blockage induced at dressing connector orifice (location 1).

Results
- Study 1: blockage alarm incidence and measured negative pressures

Table 1. Study 1: blockage alarm incidence and measured negative pressures

<table>
<thead>
<tr>
<th>Location</th>
<th>NPWT-A</th>
<th>NPWT-B</th>
<th>NPWT-C</th>
<th>NPWT-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blockage alarm, s)</td>
<td>0/9</td>
<td>9/9</td>
<td>0/9</td>
<td>9/9</td>
</tr>
<tr>
<td>Dressing NP, mmHg</td>
<td>(106 ± 4)</td>
<td>(111 ± 4)</td>
<td>(110 ± 4)</td>
<td>(112 ± 4)</td>
</tr>
<tr>
<td>Canister NP, mmHg</td>
<td>(88 ± 4)</td>
<td>(85 ± 4)</td>
<td>(86 ± 4)</td>
<td>(87 ± 4)</td>
</tr>
<tr>
<td>Time to Alarm, s)</td>
<td>(N/A)</td>
<td>(N/A)</td>
<td>(N/A)</td>
<td>(N/A)</td>
</tr>
</tbody>
</table>

- Study 2: blockage alarm incidence and measured negative pressures

Table 2. Study 2: blockage alarm incidence and measured negative pressures

<table>
<thead>
<tr>
<th>Location</th>
<th>NPWT-A</th>
<th>NPWT-B</th>
<th>NPWT-C</th>
<th>NPWT-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blockage alarm, s)</td>
<td>0/9</td>
<td>9/9</td>
<td>0/9</td>
<td>9/9</td>
</tr>
<tr>
<td>Dressing NP, mmHg</td>
<td>(94 ± 6)</td>
<td>(90 ± 6)</td>
<td>(96 ± 6)</td>
<td>(94 ± 6)</td>
</tr>
<tr>
<td>Canister NP, mmHg</td>
<td>(N/A)</td>
<td>(N/A)</td>
<td>(N/A)</td>
<td>(N/A)</td>
</tr>
<tr>
<td>Time to Alarm, s)</td>
<td>(N/A)</td>
<td>(N/A)</td>
<td>(N/A)</td>
<td>(N/A)</td>
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</tbody>
</table>

Discussion
Blockage alarms are important in alerting the user to a potential interruption in therapy. Additional studies are needed to evaluate if prolonged interruption in delivery of prescribed NPW can result in increased maceration4 and infection3 risks. NPWT systems with PRT had blockage alarms consistently when the dressing connector orifice was blocked, while NPWT systems without PRT (NPWT-D, NPWT-E, and NPWT-G) did not even when there was an obvious blockage at the canister. Thus, different NPWT systems are not necessarily equivalent.

References

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