

Low level laser therapy for healing acute and chronic wounds – the extendicare experience

Anita E Saltmarche

Saltmarche AE. Low level laser therapy for healing acute and chronic wounds – the extendicare experience. *Int Wound J* 2008;5:351–360.

ABSTRACT

The purpose of the study is to assess the effectiveness of low level laser therapy for wound healing when combined with the Extendicare Wound Prevention and Management Program. Sixteen residents at a Canadian Extendicare nursing home had a total of 27 sites treated consisting of 23 open wounds and 4 'at risk' areas. Of the 23 open wounds, two wounds in between toes were not able to be 'traced' and deemed 'immeasurable' wounds, resulting in 21 open, measured wounds. The four 'at risk' (closed) areas were treated preventatively. Pressure, venous insufficiency and diabetic wounds were included. The majority (12/21) or 57.1%, of the wounds were chronic (≥ 3 months duration) and 42.9% were acute (< 3 months duration). The primary outcome measures included the PUSH Tool score, EZ Graph™ tracings and photographs. Secondary outcome measures were employed to better understand potential barriers to successful integration into clinical practice. Feedback on the effectiveness of low level laser therapy, the education program and determinations of hands-on relevance was sought from staff. At the end of the 9-week trial, the majority (61.9%) of the 21 wounds achieved significant improvement ($\geq 50\%$ wound closure). Nine (42.8%) had 100% closure. Some improvement was seen in 14.3% and 23.8% of wounds demonstrated no change. Chronic and acute wounds had similar improvement. None of the wounds in this debilitated, frail population deteriorated during the study and no negative consequences of treatment were encountered. Without staff support, even if new technology has positive clinical outcomes, success would be limited. Staff rated low level laser, easy to learn and use, effective for the majority of their residents worth the additional time. Staff requested a continuation of low level laser even after study completion.

Key words: Chronic wounds • acute wounds • low level laser therapy • phototherapy • nursing homes

INTRODUCTION

Pressure ulcers and other chronic wounds are a common and costly problem in nursing home settings with prevalence estimates varying widely from 7 to 23 percent (1). Of particular concern are the non-healing wounds that have been previously resistant to standard treatment (2).

The care and management of chronic wounds can have significant economic consequence. Staff time for ongoing assessment, documentation, dressing changes, expensive dressings, medications, and supportive surfaces are a drain an available resources (3).

The introduction of research based technology offers positive outcomes for not only cost of chronic woundcare, but offers many other indirect benefits, especially in the nursing home setting. Incorporating an innovative, effective, safe technology encourages a progressive rather than custodial approach to care

Key Points

- pressure ulcers and other chronic wounds are a common and costly problem in nursing home settings with prevalence estimates varying widely from 7 to 23 percent
- the introduction of new, research based technology can potentially positively impact not only costs of chronic wounds, but may offer other indirect benefits in the nursing home settings

Address for correspondence: Anita E. Saltmarche RN, MHSC, VP of Clinical and Scientific Affairs, MedX Health Inc., 3350 Ridgeway Dr., Unit 3, Mississauga, ON, Canada.

E-mail: saltmarche@medxhealth.com

Requests for reprints – as above

Key Points

- the purpose of the study was to assess the effectiveness and feasibility of incorporating MedX LLLT for wound healing into the established, standardized "Extencicare Wound Prevention and Management Program"
- the Extencicare Wound Prevention and Management Program was developed by an internal multi-disciplinary team of clinicians with an interest and expertise in wounds. The program was based on the Canadian Wound Association guidelines

enhancing resident outcomes, and increasing family confidence, but also reducing staff turn over rates (4).

For over 35 years, in the EU, Australia, Asia and Russia low level laser therapy (LLLT) has been an established treatment for pain and tissue repair. It received regulatory clearance in the United States in 2002 (5). The technology has been used to enhance the healing of acute and chronic wounds. Laser and light is absorbed at a cellular level and converted into biochemical energy, thereby enhancing normal cell function and tissue repair (6).

The MedX 1000 Console system used in the Extencicare nursing home study includes two 80 mW infrared (785 nm) laser clusters for larger area treatment and a 50 mW single diode (785 nm) infrared laser probe for more focused, deeper applications. All three accessories were powered and controlled by the MedX console.

The purpose of the study was to assess the effectiveness and feasibility of incorporating MedX LLLT for wound healing into the established, standardized "Extencicare Wound Prevention and Management Program".

MATERIALS AND METHODS

Residents were enrolled only after the study was discussed with them or family members and informed consent was obtained. Residents/families were provided with information about the study, potential benefits and risks of LLLT. Informed consent was obtained from the resident or his/her Power of Attorney and placed on the chart, with a copy given to the resident or family member.

Baseline data was collected and a wound assessment was completed for each resident. They were deemed eligible for the study if they met inclusion/exclusion criteria. Inclusion required a physician order for LLLT, a chronic or acute venous insufficiency ulcer, diabetic wound or pressure ulcer (stage 1 through 4). Exclusion criteria included pregnancy, infected wounds or residents classified as palliative care. Generally, pregnancy would not be considered within the nursing home setting. But as the research protocol was being developed, admission of younger, long term rehab residents was considered. All residents in the facility who met the study inclusion/exclusion criteria were enrolled. Residents would serve as their own controls with pre and post data comparisons.

The Extencicare Wound Prevention and Management Program was developed by an internal multi-disciplinary team of clinicians with an interest and expertise in wounds. The program was based on the Canadian Wound Association guidelines.

A standardized baseline data collection form was completed for each study participant, including demographic data, medical diagnoses, medications and other co-morbidity factors that may influence wound healing. Blood flow was not readily available at the facility, therefore was not a mandatory requirement.

Outcome Measures

There were 3 primary outcome measures employed to determine the effectiveness of LLLT for wound healing:

1. PUSH Tool 3-0 scores (based on Extencicare Wound Assessments) - completed weekly
2. EZ Graph™ tracings of the wound (graphs) – completed q 2 weekly
3. Photographs of the wounds – q 2 weeks.

The PUSH Tool is a standardized method of monitoring pressure ulcers and includes the following parameters; length, width, amount of exudate and tissue type to track wound progress over time (7). The PUSH tool also has established psychometric properties, such as validity or sensitivity for wounds venous insufficiency (8). It was incorporated into the research protocol to establish a more consistent documentation format for charting wound progress, helpful with the varying levels of staff knowledge related to wound healing. It also provided a numeric score for overall progress beyond standard wound measurements. The PUSH scores were collected at baseline and weekly until completion of the study for pre and post comparison.

Generally tracing wounds with a transparency is considered more accurate than free measuring length and width (9). EZ Graph™ (a clear transparency graph material) is used for tracing wound parameters. Once completed, the removable backing was discarded and the tracing added to the nursing documentation. EZ Graph™ includes length and width measurements, type and amount of drainage and wound descriptions. All measures were taken at the point of greatest length and width. Complete healing was defined as full epithelialization of the wound with no drainage. The wound

tracings were completed at baseline and every two weeks. Pre/post LLLT comparisons determined the percentage of wound closure.

Photographs documented wound progress at baseline at two week intervals throughout the study.

Secondary Outcome Measures included a Staff Perception Survey of LLLT Effectiveness through staff consultations. Staff acceptance of any new technology influences its implementation (10). Pre staff impressions of LLLT were collected after the LLLT educational program and before initiating treatment, and was repeated 9 weeks later upon study completion. The data captured the staff's initial impressions and whether experience had changed their perceptions. Ongoing 'doability' or feasibility' was also discussed during staff meetings.

Once staff initiated LLLT therapy and again after the 9 week study, evaluations of the LLLT Education Program were collected. Questions and suggestions from the nursing staff were thoroughly discussed with support from the clinical nurse specialist from MedX.

MedX low level laser devices

The MedX Low Level Laser 1000 Console System used in the study powered and controlled three separate accessories simultaneously. Two 80 mW infrared laser clusters (16 x 5 mW, 785 nm) provided hands free larger area treatment (e.g. wound periphery and bed). A 50 mW infra (785 nm) laser probe treated deeper, more focused target tissue, such as undermining or sinus tracks.

LLLT staff education

Only the registered nursing staff involved with wound care and the dressing changes administered the LLLT. They were required to successfully complete the 2 hour MedX LLLT training program which included basic laser physics, the mechanism of action, the LLLT protocol and incorporating it into the Extencicare Wound Prevention and Management Program. Staff then demonstrated at least two patient treatments while being supervised by the instructor. Most of the registered staff in the study had previously completed a 13 week (26 hour) basic wound management course provided by a local community college.

Since LLLT is an adjunct to wound care, the LLLT Procedure was specifically developed with Extencicare to ensure that the technology was incorporated into their existing "Wound

Prevention and Management Program". Therefore, the standardized program was followed for all residents in the study with dressing orders and only altered when wound progress warranted a change.

The MedX LLLT was applied after the dressing removal and wound cleansing. The dressing was then completed as ordered.

Dosage

Two to four joules of energy /site was used around the periphery of the wound and from one to two joules directly into the wound bed. When dark eschar was present, four to six joules were delivered directly over the area. For dark residents with dark skin, the dose around the periphery was increased by 50%, as melanin absorbs photons and less is delivered to underlying tissue.

Dosage

2-4 joules (1 minute)	wound margin
1-2 joule (30 seconds)	wound bed
4-6 joules (2 minutes)	eschar

Schedule

Week 1

Daily x 5 days (based on the dressing orders thereafter)

Weeks 2-9

3 x weekly until healed or end of study (based on dressing orders changes).

Contraindications of LLLT

- direct treatment of the eyes
- treatment over pregnant uterus
- areas of acute hemorrhage
- active neoplasm
- direct treatment over thyroid gland

RESULTS

Diagnosis

The diagnosis of the wound type was made by the wound care team and attending physician and documented on the chart.

Sample description

Sixteen residents were included in the study including 9 females and 7 males. Ages ranged from 76 to 97 years with a mean age of 85.1 years old. The residents had an average of 5 medical

Key Points

- the MedX Low Level Laser 1000 Console System used in the study powered and controlled three separate accessories simultaneously. Two 80mW infrared laser clusters provided hands free larger area treatment (e.g. wound periphery and bed). A 50 mWinfra (785 nm) laser probe treated deeper, more focused target tissue, such as undermining or sinus tracks
- since LLLT is an adjunct to wound care, the LLLT Procedure was specifically developed with Extencicare to ensure that the technology was incorporated into their existing "Wound Prevention and Management Program"

diagnoses. See Table 5 for further sample description.

The sixteen residents had 27 skin areas treated (23 open wounds and 4 closed areas):

Table 1 Number and type of wound sites

No. of sites (n = 27)	Type of wound	Status of wound area
15	Pressure ulcers	Open wound
6	Diabetic ulcers	Open wound
2	venous insufficiency ulcers	Open wound
4	"at risk" areas	Closed, previous wound

The 4 residents that received preventative LLLT did not have open wounds. Rather, staff deemed them "at risk" and requested treatment. "At Risk" wounds were either acute or chronic wounds that had recently closed. Therefore, treatment was provided to decrease the likelihood of reoccurring skin breakdown.

The majority of the wounds were chronic (≥ 3 months), as demonstrated in the chart below outlining the number of wounds and length of time:

Table 2 Number and duration of wounds

No. of areas (n = 27) open wounds	Length of time
3	>2 years
3	6–12 months
11	3–6 months
6	1–2 months
4	<1 month

Primary outcome results

Each resident's results were analyzed separately on a case-by-case basis and presented in Tables 6(a) and 6(b). There were 27 areas treated

with LLLT during the study with 21 measurable, open wounds analyzed. The following 8 areas were excluded:

Table 3 Number and rationale for exclusion from analysis

No. of wounds (n = 6)	Rationale for exclusion for analysis
4	Preventative treatment for "at risk" areas, previously open wounds, but recently healed
2	Diabetic foot ulcers on top, or between toes, not accurately measured

PUSH scores

Based on the EZ graph measurements and wound assessments completed weekly, the PUSH score was calculated. PUSH scores were completed for all residents with ulcers except for 2 immeasurable wounds located on the tops of the toes, not easily traced with the slightly rigid EZ graph surface. Generally, the PUSH scores directly correlated with the rate of wound closure achieved, demonstrating a lower PUSH score with healing. In two cases, resident # 13, site 6, there was an inverse change in score from 6 to 9 with 16% wound healing. Resident #16's PUSH score only decreased by one and had a 57.1% improvement. See Tables 6 (a) and 6 (b) below.

EZ graphs

Changes from the pre LLLT to post LLLT EZ graphs™ measurements determined the percentage of wound closure in mm². The percentage of wound closure is presented in Table 4, demonstrating that the majority (57.1%) of the wounds obtained a significant percentage of closure.

Table 4 Closure rates at end of study

Number of open wounds (n = 21)	Percentage of total number	Percentage of closure	Type of wound (acute or chronic)
9	42.9%	100%	5 acute 4 chronic
4	19.0%	75–50%	2 acute 2 chronic
1	4.8%	≤50–26%	1 chronic
2	9.5%	≤25%	1 acute 1 chronic
5	23.8%	No change	2 acute 3 chronic

Table 5 Resident population description

Patient #— Items	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016
Admission Date	June 2000	July 2000	July 1999	Oct. 2000	June 1999	June 1999	Nov. 2000	Dec. 2000	Feb. 2001	Aug. 2000	Sept. 2000	April 2001	June 1999	August 2000	January 2000	April 2001
Previous History	Yes	Yes 22 yrs	No	Yes	No	No	Yes 6 yrs	Yes	No	No	No	No	No	No	Yes	No
# of Ulcers on Admission	1	2	2	2	1	1	1	2	0	0	0	0	0	0	1	0
Ulcer Stage(s)	2	22	2 X	3	2	3	1-3 over legs	24	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A
# of Meds on Admission	5	9	6	6	4	3	8	7	3	10	3	7	15	8	7	12
Number of Medical Dx	3	7	5	6	4	4	5	7	4	6	5	8	6	4	5	7
Comments		Admission ulcer healed, re-opened	Did not open	Died 3 weeks after study	B & B Incont. oozes stool		No compression used. LLLT decreased pain.		Did not open, no longer able to walk		Callus only. Not open	Died 4 weeks after study	Died 2 weeks after study			

PT = Preventative Treatment only (not open, reddened or recently healed).

Key Points

- the post Staff Impressions Survey reflected much stronger support for the ease of use, "doability" and overall usefulness of the LLLT
- there was a more realistic understanding of the time required to deliver the LLLT during dressing changes, with a direct correlation between treatment time and the number of wounds or size of total area
- this data provided important information to assist with incorporating LLLT, a new technology into practice within the nursing home setting

Table 6(a) Low level laser therapy - extendericare results

Patient #	001	002	002	003	003	004	004	005	006	007	008	009	010	010
Items	Site 1	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 2
Type of Wound*	PU	PU	VIU	PT	PU	PU	PU	PU	PU	VIU	PT	PT	PU	PU
Location	Coccyx	Coccyx	L lower Leg	L Heel	Buttocks	Coccyx	L Lat. Ankle	Coccyx	R Heel	Lower Legs	Coccyx	Coccyx	L Lat. Ankle	Coccyx
History of Ulcer	4 mths	3 mths	6 years	3-5 mths	3-5 mths	3 weeks	3 weeks	5 mths	3 mths	6 years	7-5 mths	3 mths	3-5 mths	2 mths
Pre LLLT PUSH Score	8	6	NA	NA	6	7	13	8	9	NA	NA	NA	4	4
Post LLLT PUSH Score	5	6	NA	NA	3	7	9	0	0	NA	NA	NA	0	0
Pre LLLT Wound Size (L x W) cm ²	1-5	1-75	NA	NA	2-38	1-6	6-0	-6	2-25	NA	NA	NA	-54	-42
Post Wound Size (L x W) mm ²	-65	-81	NA	NA	1	1-65	2-76	0	0	NA	NA	NA	0	0
Wound Closure	43-3%	53-7%	No change	NA	57-9%	No change	54%	100%	100%	No change	NA	NA	100%	100%
Comments			D/C'ed No compression used	Did not re-open		B & B Incont. oozes stool	Died 3 wks after study			No compression used. LLLT decreased pain.	Did not re-open	Did not re-open		

*PU, pressure ulcer; VIU, venous insufficiency ulcer; DU, diabetic ulcer; PT, preventative treatment only (not open, reddened or recently healed).

Acute and chronic wounds (≥3 month history) achieved similar rates of closure indicating that LLLT is effective for both types of wounds.

Secondary outcome results

Staff impressions of LLLT

The baseline Staff Impression's Survey completed by the registered nursing staff demonstrated varying expectations and an initial healthy level of skepticism as to the potential effectiveness of the LLLT. The post Staff Impressions Survey reflected much stronger support for ease of use, "doability" and overall usefulness of the LLLT. As well, there was a more realistic understanding of the time required to deliver the LLLT during dressing changes, with a direct correlation between treatment time and the number of wounds or size of total area. See Table 7 below.

After completing the post staff survey, two separate staff meetings were held to obtain qualitative feedback. General open-ended questions included: their overall impressions, the LLLT treatment protocol and results, the research process, the staff education and sponsor support. This data provided significant insight into the incorporation of LLLT, into practice within the nursing home setting.

"It could be time consuming for some patients but it is worth it, we saw the results."

"Relief staff from acute care stated they were surprised that nursing homes were doing leading edge technology that they weren't using yet."

*"Initially I thought the low level laser therapy would work as well as a flashlight. Now I have seen the difference it can make."*¹

Cost savings

Does the addition of LLLT to a standardized Wound Program result in cost savings? In order to answer this question, a retrospective audit was undertaken. The review established the chronic wound history, Pre (standardized Wound Program only) data compared with Post (Wound Program + LLLT) costs. Since detailed resident specific wound care costs were not generally collected at the facility, data for a pre-existing reimbursement program were utilized. Prior to the study, five residents (8 wounds) qualified for Ministry of Health, High Intensity Needs Funding. The reimbursement program

Key Points

- the combined decrease in supplies (for 8/21 wounds) and labour across the two nursing units, resulted in a total estimated cost savings of \$3280 per month. If the supplies data for all 21 wounds had been available, the savings would have been much greater

Table 7 Staff impressions questionnaire

Item	Pre	Post
Ease of use	<ul style="list-style-type: none"> 12.5% exceptional 50% very easy 37.5% moderately easy 	<ul style="list-style-type: none"> 28.6% exceptional 71.4% very easy
"Doability" (ability to incorporate into practice)	<ul style="list-style-type: none"> 12.5% exceptionally doable 25% very doable 50% moderately doable 	<ul style="list-style-type: none"> 85.7% very doable 14.3% moderately doable
Time required to complete LLLT	<ul style="list-style-type: none"> 25% minimal time 75% moderate time 	<ul style="list-style-type: none"> 85.7% moderate time 14.3% significant time
Overall usefulness of LLLT	<ul style="list-style-type: none"> 25% exceptional 25% very useful/effective 37.5% moderately useful 12.5% somewhat ineffective 	<ul style="list-style-type: none"> 85.7% very useful/effective 14.3% moderately useful/effective
Comments	<p>"I'm skeptical"</p> <p>"Not sure this is going to work"</p>	<p>"Improved rate of healing, decreased total healing time."</p> <p>"The LLLT for wound care is excellent. We have seen much improvement."</p> <p>"I feel this laser therapy has been a very good idea. I have seen much progress in all wounds since we have been doing this. I hope we will be using it again."</p> <p>"Seems to be effective for some residents but ineffective for some other chronic wounds/ulcers."</p>

required detailed documentation of the each resident's supply costs. Pre LLLT supplies cost data ranged from 3.5 – 9 months, which demonstrated that the majority of these eight wounds either deteriorated or improved slightly. When comparing the pre versus post wound supplies costs, there was a net supply savings of \$940 per month for this subset of 8/21 wounds.

Another significant wound care cost is the nursing time required for dressing changes. During the study, physicians frequently ordered daily to twice daily wet to dry dressings. Using all study participants, a random sample of simple and complex dressing changes were timed, resulting in an average 15 minutes per dressing change. In order to estimate total staff cost savings across the two nursing units in the study, the number of Pre versus Post dressing changes were also compared. Based upon wound improvement and decreased need for dressing changes, the 21 wounds yielded a monthly saving of 180 nursing hours or approximately \$2340 (180 hours x \$13/hour).

The combined decrease in supplies (for 8 / 21 wounds) and labour across the two nursing units, resulted in a total estimated cost savings of \$3280 per month. If the supplies data for all 21

wounds had been available, the savings would have been much greater.

DISCUSSION

The majority (61.8%) of the 21 measurable open wounds treated with LLLT achieved significant improvement (>50% wound closure) by the end of the 9 week study. Nine (42.8%) achieved 100% wound closure. One additional wound improved by greater than 43% and two other ulcers closed over 10%. The remaining wounds (23.8%) neither improved, nor did they deteriorate. It is worth noting the level of frailty of the study population, with many in the end stages of their lives. Within a month of completing the study, three residents died from pre-existing conditions. One had brittle diabetes and developed seven wounds, yet with LLLT, two closed, one improved by 16%, one was not measurable with three unchanged. The second participant, who died, had one wound which healed 54% and the other did not change. A month after the study, the third resident died, but had 100% wound closure.

Initially acute wounds were to be excluded from the study, however given the facility physicians request, that all stages of acute and chronic wounds were included. The study

results indicate similar wound closure rates were achieved for both chronic and acute wounds. This suggests LLLT may play an important role in enhancing wound healing regardless of chronicity.

Another potentially exciting opportunity for LLLT is in preventative treatment of "at risk" recently closed wounds that have a history of reopening. Research has demonstrated that LLLT increases microcirculation (10) and enhances tensile strength of new tissue (11).

The two chronic venous insufficiency ulcers (VIU) in the study did not improve. The likelihood of VIU wounds healing when lower limbs are grossly edematous and weeping is greatly diminished. Significantly high venous and/or arterial pressures preclude adequate blood flow thereby decreasing oxygen and nutrients to the area. In these circumstances, compression is required to decrease edema and allow wound healing (12). Immediately after the study, both residents with the VIU resisted use of compression treatment. One resident discontinued compression upon development of another cellulitis, an intermittent susceptibility for over 22 years. Based on the literature, using standard compression therapy alone for venous disease may increase healing significantly (13). Eventually this resident consented to compression and the majority of the chronic ulcers were healed. With the decrease of leg discomfort and swelling her mobility and transfer ability improved enabling more family participation in care and resident outings. Although the second resident's VIU wounds did not improve, the nocturnal pain was greatly reduced while in bed, allowing a more consistent, comfortable sleep, without medication.

The LLLT study results demonstrate positive clinical outcomes for the majority of these frail, elderly residents living in nursing home facilities. Most experience a number of co-morbidity factors, often precluding wound healing (e.g. poor nutritional and fluid intake, multiple medical conditions, such as diabetes, medications, poor mobility or transfers ability, and incontinence) (14).

The Pre Staff Survey highlighted a broad variation in expectations related to LLLT, ranging from healthy levels of skepticism to avid support. A couple of the staff had previous experience with LLLT in community with patients. The Post Staff Survey reflected more positive impressions of the ease of use, "do-

ability" and overall effectiveness of LLLT. On average the LLLT added 2–4 minutes to 6–8 minutes for large, more complex wounds dressing changes. Staff justified the time based on the results. One of the unit nursing managers commented *"With LLLT wounds appeared to have healed more rapidly than had been anticipated, and at a more rapid rate of healing that would have been expected with the standard wound protocol"*.

An unexpected, but significant benefit of the LLLT was evident with the health care aides. Since they were also part of the study education program, they stated it gave them a concrete treatment option for identified pressure points. As front line workers providing care to the residents, their active participation and vigilance can significantly impact the quality of skin care in the nursing home setting.

The 2-hour LLLT education session provided the nursing staff with sufficient knowledge and ability to incorporate MedX Low Level Laser Therapy into the Extendicare Wound Prevention and Management Program.

The literature also supports the effectiveness of LLLT for treating acute and chronic wounds (14). Previous research demonstrates LLLT increases microcirculation (15), accelerates wound closure rates (16) and increased tensile strength (17). None of the reviewed data resulted in any negative consequences from the use of the light energy for tissue repair or pain control (18). In order to determine the optimal LLLT parameters for pain control, further research appears warranted.

Although the data presented are not derived from a randomized, controlled trial, it is worthy to consider LLLT as a viable option in the treatment of acute and chronic wounds. This intervention may be particularly important to frail, debilitated, elderly residents living in nursing homes not offering alternative treatment modalities. Pain control is an often neglected issue with the older, cognitively impaired population. LLLT has established positive effects in pain control for a variety of musculoskeletal conditions (19). Since nursing home residents already take numerous drugs (study average, 5.4 medications), this potentially could substantially decrease risk of drug interactions and associated deteriorations in physical and cognitive functioning. These facilities are susceptible to substantial financial, regulatory and litigation consequences when wounds develop or progress while in their care.

Key Points

- the study results indicate similar wound closure rates were achieved for both chronic and acute wounds suggesting LLLT might play an important role in enhancing wound healing regardless of chronicity
- another potentially exciting opportunity for LLLT is preventative treatment for "at risk" recently closed wounds that have a history of reopening
- research has demonstrated that LLLT increases microcirculation (10) and enhances tensile strength of new tissue
- the LLLT study results demonstrate positive clinical outcomes for the majority of these frail, elderly residents living in nursing home facilities
- previous research demonstrates LLLT increases microcirculation, accelerates wound closure rates and increased tensile strength
- although the data presented are not derived from a randomized, controlled trial, it is worthy to consider LLLT as a viable option for treating acute and chronic wounds
- LLLT has established positive effects in pain control for a variety of musculoskeletal conditions

Key Points

- in summary, the study findings suggest that MedX low level laser therapy is a safe, efficacious adjunct to a standardized Wound Program, with the added potential resident benefit of decreasing pain

In summary, the study findings suggest that MedX low level laser therapy is a safe, efficacious adjunct to a standardized Wound Program, with the added potential resident benefit of decreasing pain. The facility also benefits from significant reductions in supplies and staff costs.

REFERENCES

- 1 Smith DM. Pressure ulcers in the nursing home. *An of Internal Med* 1995;123:433–438.
- 2 Woodbury MG, Houghton PE. Prevalence of pressure ulcers in Canadian health-care settings. *Ostomy/Wound Management* 2004;50(10):22–38.
- 3 Woodbury MG, Houghton PE. Prevalence of pressure ulcers in Canadian health-care settings. *Ostomy/Wound Management* 2004;50(10):22–38.
- 4 Freedman VA, Calkins M, DeRosiers R, Van Haitsma K. Barriers to Implementing Technology in Residential Long-Term Care Settings, Polisher Research Institute US Department of Health and Social Services, December 10, 2005.
- 5 Tuner J, Hode L. *The laser Therapy Handbook*, Prima Books: Grandsberg, Sweden, 2002.
- 6 Tuner J, Hode L. *The laser Therapy Handbook*, Prima Books: Grandsberg, Sweden, 2002.
- 7 National Pressure Ulcer Advisory Panel, The PUSH (Pressure Ulcer Scale for Healing) Tool, Version 3, 9/15/98.
- 8 Thawer HA, Houghton PE, Woodbury MG, Keast D, Campbell K. A comparison of computer-assisted and manual wound size measurement. *Ostomy Wound Management*, 2002, Oct; 48(10):46–53.
- 9 Sussman C. Expanding wound care protocols. *Rehab Management* 2000; Nov, 30–33.
- 10 Perricone N. (ed). How to approach acute and chronic wound healing in the elderly. *Wounds* 1999;11(6):145–151.
- 11 Houghton P, Campbell K. Choosing adjunctive therapy for the treatment of chronic wounds. *Ostomy/Wound Management* 1999;45:43–52.
- 12 Cullen N, Nelson EA, Fletcher AW, Sheldon TA. Compression for venous leg ulcers. *Cochrane Database of Systematic Reviews*, 1999. Issue 3. Art. No.:CD000265. DOI 10: 1002/1465 1858. CD000256.
- 13 Cullen N, Nelson EA, Fletcher AW, Sheldon TA. Compression for venous leg ulcers. *Cochrane Database of Systematic Reviews*, 1999. Issue 3. Art. No.:CD000265. DOI 10: 1002/1465 1858. CD000256.
- 14 Enwemeka CS. Laser biostimulation of healing wounds: Specific effects and mechanisms of action. *J Ortho and Sports Physical Therapy* 1988;9(10):333–337.
- 15 Baxter GD. (1997) *Therapeutic Lasers, Theory and Practice*. New York, NY: Churchill Livingstone Inc.
- 16 Conlan MJ, Rapley JW, Cobb CM. Biostimulation of wound healing by low level energy laser irradiation. A review. *J of Clin Periodontology* 1996;23: 492–496.
- 17 Baxter GD. (1997) *Therapeutic Lasers, Theory and Practice*. New York, NY: Churchill Livingstone Inc.
- 18 Woodruff LD, Bounkeo JM, Brannon WM, Dawes KS, Barham CD, Waddell DL, Enwemeka CS. The efficacy of laser therapy in wound repair: A meta-analysis of the literature. *Photomedicine and Laser Surgery*, June 2004;22:3,241–247.
- 19 Bjordal JM, Johnson MI, Iversen V, Aimbire F, Lopes-Martins RAB. Low-level laser therapy in acute pain: A systematic review of possible mechanisms of action and clinical effects in randomized placebo-controlled trials. *Photomedicine and Laser Surgery* 2006;24(2):158–168.