A Feasibility Study of Transdermal Buprenorphine Versus Transdermal Fentanyl in the Long-Term Management of Persistent Non-Cancer Pain

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Abstract

Objective. Buprenorphine and fentanyl transdermal patches are used widely for the management of persistent malignant and nonmalignant pain. Buprenorphine and fentanyl transdermal patches, both potent opioids, are considered to be equally efficacious in managing persistent pain. Various retrospective studies comparing dosage changes of buprenorphine and fentanyl patches in persistent pain patients have been completed; however, no long-term prospective, randomized, clinical study has compared the effectiveness of these patches. The objective of the present study was to satisfy this need.

Aims. This study aims to compare prospectively the long-term efficacy, acceptability, and side effects of both of these patches in patients with persistent pain. This study would examine the feasibility and lay the groundwork for a larger, multicenter study where such efficacy and safety outcomes of the two medications can be adequately assessed.

Design. The participants were 46 adults (range 22–80 years) with nonmalignant persistent pain (mean = 11 years), predominantly with lower back pain. Data were obtained monthly for 12 months. Participants recruited were opioid-naïve patients, having pain for the greater part of the day and night, and appropriate for treatment with transdermal patches. After initial assessment, participants were randomly allocated to either buprenorphine or fentanyl patch treatment. Participants were then titrated to optimal doses of medication. Patients with adverse effects or unsatisfactory pain relief were treated alternatively and discontinued from the study.

Results. Nearly one-third of all patients, 41% (8 of 22) of the transdermal buprenorphine (TDB) group and 37.5% (8 of 24) of the transdermal fentanyl (TDF) group stopped treatment due to unacceptable side effects or inadequate pain relief. The remaining participants showed a similar trend in the improvement of pain intensity, physical activity, sleep, and mood throughout the study. Significant relief in the intensity of pain was achieved for the initial 6 months and the effects stabilized in the remainder of the study in both groups. There were no significant group differences over time. However, a higher equipotent dose of fentanyl was required for comparable pain relief. Compared with TDF group, the TDB group initially experienced relatively less side effects. However, a greater number of buprenorphine users suffered from local skin reactions. Buprenorphine users had significant improvement in mood. Thirty-one percent (5 of 16) of the buprenorphine group and 57% (8 of 14) of the fentanyl users needed additional pain relief medications by the end of 3 months. By the end of 12 months, a significant number 78% (7 of 9) of buprenorphine users but comparatively fewer 44% (4 of 9) of the fentanyl group used rescue medicines. Both had more doctor visits in the latter half of the study.

Conclusion. Thirty percent of the total number of patients discontinued treatment because of side effects or unsatisfactory pain relief. For those continuing treatment, clinical improvements were seen in the initial 6 months in both groups. Fifty percent of the TDB and 43% of TDF groups had significant relief in 3 months, which persisted up to 6 months. Only 11% and 13% of patients, respectively, had sustained relief after 6 months. Twenty percent more
patients in the TDB group benefited significantly in symptoms of depression from TDB compared with the TDF group. Interestingly, switching of patches seemed to increase acceptability by preventing adverse effects and tolerance. Confirmation of these effects should be studied in future with a multicenter study and larger sample.

Key Words. Persistent Pain; Fentanyl; Buprenorphine; Transdermal

Introduction

Persistent nonmalignant pain can be challenging for patients however this can also be challenging for the doctors treating them [1,2].

Persistent nonmalignant pain may well be resistant to treatment due to complex factors such as psychosocial, psychiatric, or addiction, or other comorbidities [2].

Opioids and their synthetic derivatives including fentanyl and tramadol are effective analgesics for some persistent pain conditions if used judiciously [3]. Physicians may be somewhat reluctant to treat patients of persistent pain because of fear of professional censure, patient addiction, or poor knowledge of regulatory restrictions on prescribing controlled medication [1,4].

Furthermore, poor outcomes of treatment and the need for more time and better resources for monitoring patients on opioids are deterrents for physicians and particularly general practitioners treating persistent pain [1].

In clinical practice, physicians ideally need evidence-based guidelines for effective management of conditions and knowledge of adequate doses of medications [2,5].

Transdermal fentanyl (TDF) and transdermal buprenorphine (TDB) were introduced in Australia in 2001 and 2005, respectively, for treatment of persistent malignant and nonmalignant pain [5–7]. Buprenorphine is a potent partial mu-receptor agonist and kappa-receptor antagonist, which is up to 40 times more potent than morphine [8]. It is available as sublingual, parenteral, and transdermal preparations [9].

Fentanyl is the oldest synthetic opioid mu-receptor agonist and is about 80 times more potent than morphine [10]. Fentanyl can also be administered through transbucal, parenteral, and intranasal and transdermal routes [11]. TDB and TDF patches are designed to deliver their medications at a continuous rate over several days [12,13]. Prospective studies for comparing long-term effects, efficacy, and risk of addiction in patients being treated by opioids are scarce [14].

A retrospective study comparing effects of TDB and TDF patches in persistent pain showed that TDB is more effective than TDF in terms of life years gained and was associated with a lower risk of constipation or respiratory depression compared with other narcotics [10]. Vander Hulst et al., in a study of five patients, demonstrated evidence of delayed hypersensitivity to TDB patches [15]. Although these and other studies have emphasized the need for further verification of results by long-term prospective, randomized, clinical studies, to date, no evidence of head-to-head comparison of fentanyl and buprenorphine patches were found [16,17]. Additionally, results on superiority of fentanyl or buprenorphine in terms of adverse reactions on patients are equivocal [18,19]. In a retrospective analysis of 425 patients, significantly less constipation was found with transdermal opioids compared with slow-release oral morphine [18]. In three trials investigating TDF, TDB, and slow-release morphine, patients significantly preferred fentanyl [19].

In the present prospective study of feasibility, we aimed to compare the effects of TDB and TDF in terms of pain intensity, dosage changes over time, and adverse effects. We could find no studies that were prospective or included 1-year follow-up data [16,20,21]. This study also aimed to assess the global impact of these two medications on patients with persistent pain, specifically looking at improvement in sleep, activity levels, occasions of health services used, additional pain relief, medication usage, and mood.

Methods

This study was conducted according to guidelines approved by The Townsville Hospital Human Research Ethics Committee. This study was a single-site, open-label design where participants and clinicians, but not the assessor, were aware of the medication being used. It was a prospective, randomized, longitudinal study over 12 months. Participants were randomly selected for treatment by TDB or TDF patches by asking participants to pick a label marked A or B from a closed box: A = TDF, B = TDB. After the treatment was initiated, participants were followed up monthly for up to 12 months.

Participants

Participants were recruited at a tertiary hospital Multidisciplinary pain management clinic. Participants’ demographics are outlined in Table 1. The study included 22 male and 24 female adult participants (aged 22–80 years; mean 49) with long-term pain ranging 6 months to 50 years (mean pain duration 11.7 years). Patients who reported persistent pain for the greater part of the day or night for at least 1 year, who were opioid-naïve, and who were appropriate for treatment with transdermal patches after a medical assessment were recruited. All participants were provided with written information sheets, and informed consent was obtained before entering the study. After history taking, clinical examination, and appropriate investigations, treatment was initiated by a senior medical clinician. Follow-up of
Procedure

Participant progress was studied across seven domains: score of pain (S), physical activity (P), additional rescue medication (A), additional general practitioner/emergency department (GP/ED) visit (A), sleep quality (S), mood (M), and side effects of pain medication (S) (SPAASMS) (Table 2).

Each measure was self-rated by participants on a 0–3 scale based on severity of symptoms. Pain was measured on a scale of 0–10. SPAASMS was recorded and scored to a maximum of 28 each month. SPAASMS was recorded to a maximum of 25 at the initial assessment because it excluded the score for side effects of the medication.

The precise method of application of the patches was clearly explained to participants. Participants were started on the minimum dose of fentanyl (12.5 µg/h) or buprenorphine (5 µg/h), and were titrated to optimal doses of each medication over 4 weeks. Participants were not restricted for over-the-counter (OTC) medicines, such as paracetamol or low-dose nonsteroidal anti-inflammatory drugs, as rescue medication. Participants were asked to keep a record of any additional analgesics used and doctor visits resulting from aggravation of pain but not for other illness. Participants who had unsatisfactory relief or developed severe adverse reaction/s were given alternative medications other than patches and were withdrawn from the study. Remaining participants were monitored monthly for 12 months. Monthly SPAASMS was administered by a trained interviewer. The treating clinician evaluated each participant’s progress independently at 3 monthly intervals. Details of any aggravation or improvement of symptoms were elicited, and increased doses of TDF or TDB were given as clinically indicated. Additional multidisciplinary support was available to all participants. Participants also completed the Depression, Anxiety, and Stress Scale-21 Items (DASS21), and the Physical Disability Index-7 Items (PDI) questionnaires at the beginning of the study and then every 3 months. The final scores of SPAASMS, DASS21, and PDI were recorded, and results were collated.

Statistical Analyses

An Internet search did not reveal a scale to measure the earlier domains in real time; therefore, the authors devised a rapid pain assessment tool, the SPAASMS scale [22]. This scale was validated before participants’ progress on treatment was studied. Validation of this tool was done by statistical analysis, and overall assessment of reliability was conducted using test–retest data. A scatter plot was used for graphical assessment of reliability. A concordance correlation coefficient was calculated. Cronbach’s alpha was calculated to assess internal consistency of SPAASMS using PASW (PASW version 18, SPSS, Inc., Chicago, IL, USA). All other statistical analyses were performed using Graphpad software (Version 5, GraphPad Software, Inc., La Jolla, CA, USA). Clinical

### Table 1  Participant demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Characteristic Summary Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age, SD, range</td>
<td>(aged 22–80 years; mean 49) SD?</td>
</tr>
<tr>
<td>% female</td>
<td>52</td>
</tr>
<tr>
<td>% diagnosis (%)</td>
<td></td>
</tr>
<tr>
<td>Back pain</td>
<td>61</td>
</tr>
<tr>
<td>Others</td>
<td>39</td>
</tr>
<tr>
<td>Duration of pain</td>
<td>(6 months to 50 years; = mean 11.7 years) SD?</td>
</tr>
<tr>
<td>Duration of follow-up (%)</td>
<td></td>
</tr>
<tr>
<td>To 3 months</td>
<td>35</td>
</tr>
<tr>
<td>To 6 months</td>
<td>13</td>
</tr>
<tr>
<td>To 12 months</td>
<td>52</td>
</tr>
</tbody>
</table>

N = 46.
SD = standard deviation.

Comparison of Transdermal Patches in Persistent Pain

### Table 2 SPAASMS score card

<table>
<thead>
<tr>
<th>Patient’s name</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain on Numerical Rating Scale</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Activity and mobility</td>
<td>Very good</td>
</tr>
<tr>
<td>Additional pain medication</td>
<td>Nil</td>
</tr>
<tr>
<td>Additional GP/ED visits</td>
<td>Nil</td>
</tr>
<tr>
<td>Sleep Quality</td>
<td>Very good</td>
</tr>
<tr>
<td>Side Effects</td>
<td>Nil</td>
</tr>
<tr>
<td>Mood</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Total Score = 25 (Initial)  
Total Score = 28 (Monthly).
measures concerning pain intensity, including Numerical Rating Scale (NRS), DASS21, PDI, etc., were based on mean, standard error and range. Two-way repeated measures or analysis of variance was used for comparison between SPAASMS, NRS, DASS21, and PDI, followed by Bonferroni post-tests. Pearson’s correlation coefficient ($r^2$) was computed to examine the correlation between SPAASMS, NRS, PDI, and DASS21 scores. The relationship between SPAASMS, and NRS and NPD was not checked, as NRS was one component of the SPAASMS score card. All $P$-values were two-sided, with $P$-values of less than 0.05 considered significant.

Results

Sixteen out of 46 participants continued treatment with the transdermal medication, gaining effective relief for 12 months. Forty-one percent (8 of 22) of the TDB group and 37.5% (8 of 24) of TDF group discontinued patch treatment due to side effects or reporting unsatisfactory pain relief.

Effectiveness of Medication on Pain Levels

Both TDF and TDB showed a similar pattern in pain intensity (Figure 1) throughout the study. Both patches demonstrated an acceptable response with stable doses during the initial 3 months. However, there was no significant difference in any dimension between groups or over time. The effects of the medicines stabilized after 6 months.

At 3 months, reported pain was reduced by a significant three points on the visual analog scale (Figure 1) at 3 months for both TDB 50% (8 of 16 participants) and TDF 43% (6 of 14 participants). Significant pain relief was reported by 8% after 6 months and by 11% after 12 months (Figure 2).

Comparison of TDF and TDB Dose with Equipotent Dose of Morphine for Gaining Pain Relief

All patch dosages were recalculated to morphine equivalent to an equipotent dose using a widely applied guide, “DUROGESIC®: Simple Dosing Guidelines.” Compared with TDB, participants on TDF used significantly higher equipotent initial and last dose to achieve satisfactory pain relief (Figure 3). Compared with initial dose, the increment was significantly higher in the last dose for both patches.

![Figure 1](https://example.com/figure1.png)

Figure 1 Transdermal fentanyl and transdermal buprenorphine groups showed similar trend of improvement in pain intensity. Error bars 95% confidence interval. VAS = visual analog scale.

![Figure 2](https://example.com/figure2.png)

Figure 2 Patients in the two groups showing significant pain relief; error bars 95% confidence interval.

![Figure 3](https://example.com/figure3.png)

Figure 3 Equivalent doses of morphine compared with transdermal fentanyl and transdermal buprenorphine; with satisfactory pain relief; error bars 95% confidence interval.
However, dose-increment ratio between initial and last dose (mean last dose/mean initial dose) of each patch was comparable (4.58 vs 4.73).

**Doctor Visits and Rescue Medication**

The frequency of health care facility visit and additional medication usage was comparable between TDB and TDF groups throughout the study. However, toward the end of the study, an increase in frequency of health facility visit and medication usage was observed in the TDB group. Interestingly, the percentage of participants using rescue medicines was higher for TDF group during the initial phase, while the percentage was higher among TDB users at later phase.

**Side Effects of TDF and TDB**

Throughout the study, TDF participants suffered relatively more side effects than the TDB group (Figure 4A). Immediate side effects, namely nightmares, nausea, and increased drowsiness, were shown to be more intense with TDF patch as shown by the higher number of participants who discontinued from the study within 1 month of treatment. TDB had a stronger delayed onset of adverse effects as evident by the number of participants having ceased the treatment at a later stage. More TDB users complained of local skin reactions, such as itching, redness, swelling, blisters, etc, and stopped the patch at a later stage (Figure 4B).

**Mental Status at 6 Months**

There were no significant differences between the two groups in SPAASMS scores (Figure 5D), PDI (Figure 5B), and DASS21, with the exception of DASS21 (Figure 5A) at 6 months where buprenorphine users had significantly reduced distress compared with the fentanyl users. In general, both patches were associated with improvement in participants’ clinical status for the first 6 months, then the effects stabilized.

**Discussion**

A 5-week prospective study has compared the effects of TDB with oral morphine in non-cancer pain participants [20]. Aurilio et al. found no significant difference in either pain relief or rescue medication use after interswitching of medication between TDB and TDF groups of chronic cancer patients [23]. However, the authors were unable to find studies that compare TBP and TDF with 6-month follow-up data.

In the present 12-month-long prospective feasibility study, the effects of fentanyl and buprenorphine patches on pain intensity, physical activity levels, sleep, mood, morphine equipotent dosage, adverse reaction, frequency of health care facility visits, and additional medication usage for breakthrough pain were assessed. This study also compared the two medications using well-established scoring tools like DASS21, PDI, and a recently developed validated tool, SPAASMS (Table 2). This study found that buprenorphine and fentanyl users had a comparable trend in pain, physical activity, sleep, and mood dimensions throughout the study period.

In one post-marketing surveillance study of TDB over a 10-week observation period, Griessinger et al. identified that 80% of participants with persistent non-cancer pain achieved good or very good pain relief with TD [24]. Clark et al.’s analysis of a large data repository found that treatment with TDF patch over at least 28 days significantly improved persistent non-cancer pain when compared with sustained-release oral morphine [25]; however, as no head-to-head study was done, any data directly comparing these two patches was unavailable.

Our objective was to enroll 50 participants in each group; however, being a single-centre study, remoteness of the catchment area, low compliance, and patient relocation, our expectations in recruiting participants were not met.

In this study, participants who had no or few side effects responded well to both patches during the first 3 months, with good pain relief being achieved during this period.
Sixteen of the 36 participants discontinued from the study due to adverse effects. Approximately 50% of buprenorphine users and 43% of fentanyl users achieved similar pain relief over a 3-month period. Additionally, it was found that pain relief from both patches gradually decreased after this time. Only 8% and 11% of users of both patches had significant pain relief at the end of 6 and 12 months, respectively. This could be due to participants developing tolerance to opioids, as prolonged use can induce changes that reduce the efficacy of the drug over time [26].

Pace et al.’s randomized, open-label, prospective study of chronic cancer pain found that compared with sustained-release morphine, TDB can significantly improve quality of life, including physical activity in chronic cancer pain [27]. Gianni et al.’s prospective study among elderly chronic non-cancer pain subjects over a 90-day period showed that basic activities of daily living significantly improved with TDB [28]. Mordarski et al.’s work with fentanyl patches has been shown to improve physical activities in participants with the persistent pain of post-herpetic neuralgia [29].

In the present study, the functional daily activity of the participants was assessed by a self-reported seven-item, 10-point PDI and also on the monthly four-point average activity and mobility component of SPAASMS scale. Although no significant difference in physical activity was found between the two transdermal patch groups over 3 monthly intervals, the pattern of improvement in both groups was sustained for the initial 6 months.

Gianni et al.’s studies also found that TDB can significantly increase the duration of sleep in elderly patients with chronic non-cancer pain [28]. Pace et al. showed significantly greater relief in pain and improvement in quality of sleep with TDB as compared with sustained-release morphine over an 8-week period [27]. This is also supported by Ahmedzai’s demonstration that in comparison with oral morphine, cancer patients enjoyed significantly better sleep quality with TDF [30]. In the present study, although not statistically significant, both groups reported improved quality of sleep for the initial 6 months although it was more pronounced in TDB users. After 6 months, however, quality of sleep was stabilized in both groups.

Gianni et al.’s short-term study of TDB on chronic non-cancer patients also demonstrated improvement in mood [28]. TDB was also associated with improved mood in patients with chronic ischemic pain due to peripheral vasculopathy [31]. Using the Short Form-36 Quality of Life Questionnaire, Pace et al. showed that compared with slow-release morphine, TDB use resulted in significantly improved mental health in chronic cancer pain patients [27]. Ahmedzai’s work mentioned earlier described positive effects of TDF on mood; TDF was reported to lessen tension and anger [30]. Similarly, Mordarski et al. found that TDF can be associated with improved mental functioning of persistent neuropathic pain patients [29].
TDF usage has also been shown to improve mood in about 37% of patients with acute pain [32]. Unfortunately, these studies were of short duration and did not directly compare the TDF and TDB. The present study considered the effect of long-term usage of both TDB and TDF in regards to the mental status of persistent non-cancer pain patients. Mood in both groups improved for the first half of the study. When DASS21 was considered, TDB group had significant improvement when compared with that of TDF at 6 months (Figure 5A). In fact, during this 12-month study, the TDB group had a relatively better overall mental status reflected by the DASS21 score, which also significantly correlated with the one-item scale in the SPAASMS.

Griessinger et al.’s postmarketing surveillance study mentioned earlier found that 48.4% of non-cancer chronic pain patients with TDB used analgesic comedication or rescue therapy [24]. Aurilio et al. found no significant difference in either pain relief or rescue medication use after inter-switching of medication between TDB and TDF groups of chronic cancer patients. However, Aurilio et al. completed this study in 3 weeks [23]. In the present 12-month study, about 31% and 57% of participants with TDB and TDF, respectively, did require additional analgesic by the end of 3 months, although a higher number of participants on TDB used additional OTC pain medication more frequently. As the study progressed, the trend was quite opposite with TDF users. Different factors may be responsible for this effect, including age, gender, participants’ lifestyle, daily activities, and significant events during this specific period. It may also be possible that the higher equipotent initial and last dose of TDF may be responsible for lesser use of rescue medications in this group.

Similarly, albeit not statistically significant, it was found that during the initial 3 months, health care facility visits were higher with fentanyl than buprenorphine users, although this is likely to be a result of higher incidence of adverse reactions. By the end of 12 months, this finding was reversed, and buprenorphine users had higher incidence of doctor visits for breakthrough pain, additional medication, adverse reaction, and inefficacy.

Throughout the study, TDF users reported more intense adverse reaction than TDB users. These stronger side effects of fentanyl may be due to higher equipotent dosage of the medication at initiation. However, numbers of patient who discontinued the patch during the study period were comparable; 41% (8 of 22) of TDB users and 37.5% (8 of 24) of TDF users stopped the patch. Again, while most of the TDF users stopped the patch relatively early, more TDB users stopped using the patch at a later stage. This could be explained by a delayed type of local skin irritation. Studies have shown that TDB patch can cause local skin reactions, including erythema and pruritus, among others [18,33,34]. In the current study, it was found that in comparison with TDF, a greater number of TDB users complained of local skin reactions (Figure 4B). Five participants in TDB group stopped the medication due to skin irritation between 1 and 6 months, while only one participant in the TDF group stopped medication at the end of 9 months for the same reason. Indeed, studies have shown concern regarding delayed type of hypersensitivity to TDB [20,35].

This could be due to buprenorphine itself or any compound used in the product. The possibility of these reactions being intense is considerably more in a tropical climate. The application of TDF for 1 week at a time, as opposed to 3-day change of TDF, might have caused irritation of the skin with perspiration under the patch. In fact, two participants from TDB group noted blistering of the skin. Anecdotally, participants in the TDF group had difficulties with spontaneous detachment of the patch earlier than 3 days probably again due to sweating in the hot humid climate. The effectiveness of the patch could also decrease because of the detachment of the patch by collection of sweat between the patch and the skin.

Interestingly, no participants complained of constipation as side effects contrary to the findings of Wirz et al. [21]. However, unlike our study, Wirz et al. included only participants of cancer pain.

When the cumulative effects of both medications were assessed by the SPAASMS scale, the maximum overall clinical improvement was for the initial 6 months only. It is likely that tolerance developed gradually in both groups from 6 months onward. We encountered problems in recruiting greater number of participants due to varied reasons. These included that being a single-centre study, fewer participants were suitable for treatment with transdermal patches, strict patient selection criteria, restricted resources for staffing, and time limitations of project. Again, there was steady decrease in patient numbers after initiation of transdermal medication due to various reasons including side effects, so that our data did not always show significant differences between the patches. However, an advantage of this single-centre study was that we were confident about the consistency of the collected data. Further multicenter studies with larger sample numbers may address this issue.

World Health Organization Guidelines for cancer palliative treatment has recommended rotation of opioids to ease the adverse effects and tolerance [36]. The clinical observations noted in this study found that switching of patches could benefit nonmalignant pain patients in terms of side effects and tolerance. The present study has provided unique findings comparing two transdermal patch medications over 12 months. A multicenter study is also feasible based on these results. Future research may be directed to explore this possibility. Should these results be replicated, they would support clinical guidelines for the use of TDB and TDF patch medications in persistent pain.

It is also crucial to elucidate the underlying reason/s for the skin reaction for better patient compliance (Figure 6).

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Figure 6 Schematic representation of results. TDB = transdermal buprenorphine; TDF = transdermal fentanyl.

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References
9 Narcotics Anonymous (NA). Buprenorphine (Buprenex inj., Subutex tabs and SL); can be taken po, intranasally and IV or subcutaneously; 1996. Available at: http://www.na.org/ (accessed May 31, 2011).


