Honey dressing versus paraffin tulle gras following toenail surgery

• **Objective:** Anecdotal reports suggest that certain honey dressings have a positive effect on wound healing. However, there is limited empirical evidence supporting its use. This double-blind randomised controlled trial investigated the effect of a honey dressing on wound healing following toenail surgery with matrix phenolisation.

• **Method:** Participants (n=100) were randomly assigned to receive either an active manuka honey dressing (n=52) or paraffin-impregnated tulle gras (n=48). The primary outcome was time (days) taken for complete re-epithelialisation of the nail bed.

• **Results:** Mean healing times were 40.30 days (SD 18.21) for the honey group and 39.98 days (SD 25.42) for the paraffin tulle gras group. Partial avulsion wounds healed statistically significantly faster (p=0.01) with paraffin tulle gras (19.62 days, SD 9.31) than with the honey dressing (31.76 days, SD 18.8), but no significant difference (p=0.21) was found following total avulsion when comparing honey (45.28 days, SD 18.03.) with paraffin tulle gras dressings (52.03 days, SD 21.3).

• **Conclusion:** The results suggest that patients may benefit more from paraffin tulle gras dressings than honey dressings following partial toenail avulsion. No statistically significant difference was found for healing times after total toenail avulsion, although the marginal benefit of the honey dressing on these healing times warrants further investigation.

• **Declaration of interest:** None.

honey dressings; randomised controlled trial; toenail surgery; wound healing

Honey has been used medicinally for millennia,[1] with records dating back as far as 50 AD.[2] Its decline in use, particularly over the past half century, has been attributed to the advent of systemic antibiotics and modern wound-care products.[2] However, with the development of antimicrobial resistance, interest in honey has revived due to anecdotal, experimental and clinical evidence on its inhibitory action against common wound-infecting species of bacteria, including *Staphylococcus aureus* and methicillin-resistant *Staphylococcus aureus* (MRSA). It has also been suggested that honey has a positive influence on wound healing owing to its anti-inflammatory role and stimulation of granulation tissue.[3,4]

Toenail pathologies requiring surgical intervention are often observed in podiatric practice.[5] A recent randomised controlled trial (RCT) comparing effectiveness of toenail surgery by surgeons in secondary care with that by podiatrists in primary care[5] indicated that patients undergoing podiatric surgery required analgesia for a significantly shorter time, had a reduced need for antibiotics and lost significantly fewer days to sickness when compared with the surgeons group. However, wounds in the surgeons group healed significantly faster than those in the podiatry group. This was attributed to the corrosive nature of phenol, which podiatrists often use during nail surgery. Phenol is used as a liquid caustic to destroy cells in the nail matrix, preventing nail regrowth.

Historically, paraffin tulle has been the primary dressing of choice following toenail surgery, although it can cause pain and trauma on removal. King[6] suggested that its use as a primary dressing post-toenail avulsion should be discontinued due to adhesion to the nail bed and pain on removal. However, King's sample size was small, pain assessment was subjective and the exact surgical procedure used (invasive, requiring sutures, or non-invasive with matrix phenolisation) is unclear. King's study does, however, identify a gap in the evidence on the most suitable postoperative dressing.

Several RCTs[7–11] have shown that honey has antibacterial and anti-inflammatory properties and can stimulate granulation tissue. These properties and effects vary depending on the flora source.[12] Microbiological studies have demonstrated the superior antibacterial properties of manuka honey,[13] attributed to an unidentified phytochemical component.[2]

A systematic review concluded that the current evidence base is limited. As a result, confidence in the use of honey in wound care is low.[14] To the best of our knowledge, only eight RCTs have investigated the effect of honey on wound healing, of which one looked at the effect of medicated honey following toenail surgery.[15] However, the external validity of the eight studies is debatable, mainly due to the small sample sizes. In all cases honey was compared with an alternative dressing material such as polyurethane film,[7] silver sulphadiazine[8] and povidone-

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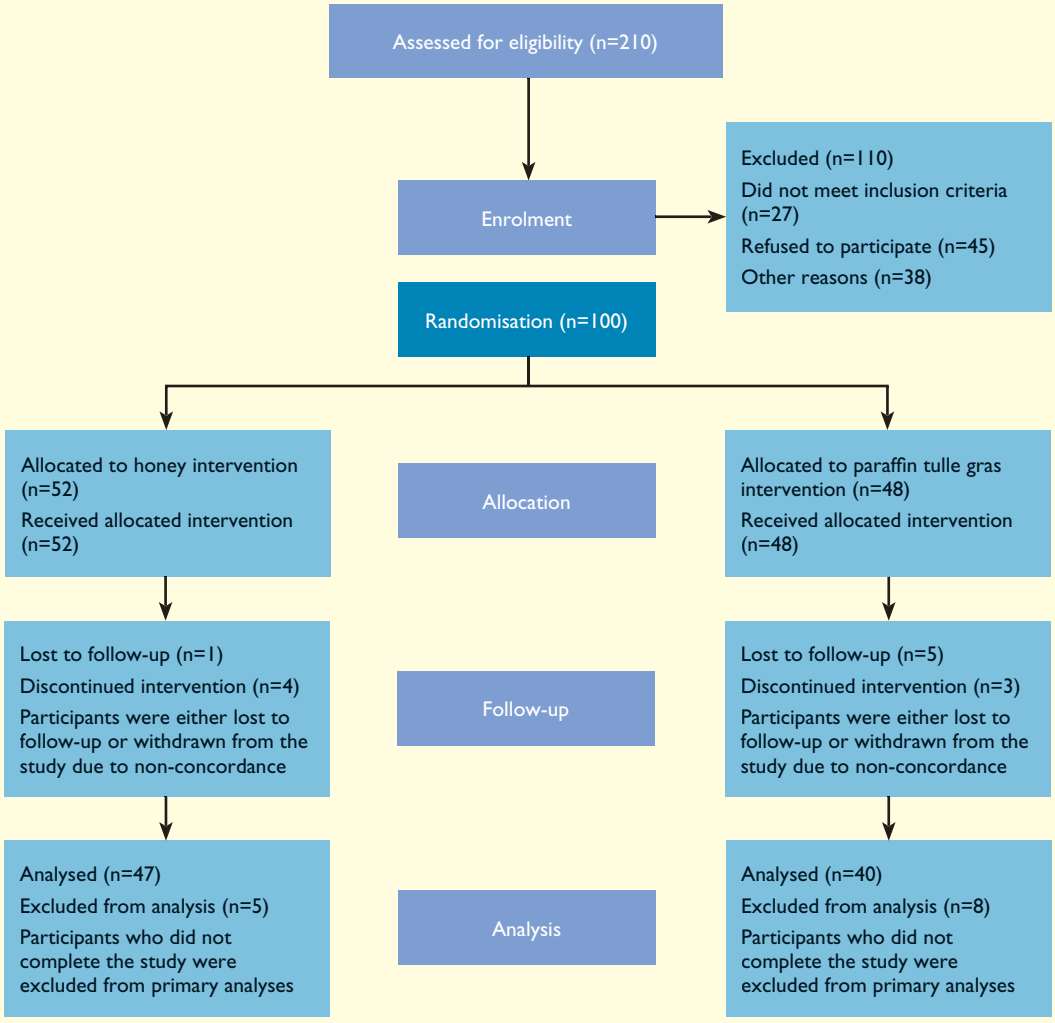
Fig 1. Flow of participants through the study



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iodine,[9,15] and in six studies was found to be superior in terms of healing times and eradication of infection.[7-9,10,11,16] However, two studies found the comparator was superior to honey: when healing times following toenail surgery were measured, povidone-iodine was found to be superior to medicated honey,[15] and early tangential excision and skin grafting were superior to honey[17] in the treatment of moderate burns. The need for further RCTs with larger sample sizes, blinded assessment and comparison with standard wound treatment is evident.

This study therefore was designed to test the hypothesis that manuka honey dressings are superior to paraffin-impregnated tulle dressings in reducing healing times following toenail surgery with matrix phenolisation.

Method

This pragmatic trial was undertaken in a general hospital setting in the North-East of England. All patients referred to the department of podiatry and foot health for assessment for toenail surgery between July 2002 and August 2003 were invited to take part. Participants gave written consent.

Following pre-surgical assessment, patients who matched the inclusion criteria — aged over 16 years, showed no evidence of peripheral vascular disease (ankle brachial pressure index >0.8), had intact peripheral sensation determined with a 10g monofilament — and who were deemed suitable for toenail surgery requiring either unilateral, bilateral, partial or total toenail removal with matrix phenolisation were eligible to participate.

All surgery was performed under local anaesthesia by a senior podiatrist in an outpatient setting, as was follow-up. Exclusion criteria were:

- Peripheral vascular disease or peripheral neuropathy
- Under 16 years of age
- Communication difficulties
- Unable or unwilling to give informed consent or attend follow-up appointments.

Ethical approval, sought from Scarborough Hospital local and regional ethical committee, was granted in July 2002.

Interventions

Two dressing materials were compared:

- ApiNate, an active manuka honey-impregnated alginate dressing (Apimed, Cambridge, New Zealand; now manufactured as Algivon by Advancis)
- Jelonet, a paraffin-impregnated tulle gras (Smith & Nephew).

All participants were seen twice weekly for redressing and assessment until complete wound healing occurred. Every redressing followed a standard protocol: removal of soiled dressings; irrigation of the nail bed with sterile saline; application of honey or Jelonet and a secondary, sterile, dry dressing (Melolin, Smith & Nephew).

Outcome measures

The primary outcome measure was time (days) for complete healing of the nail bed to occur. Healing times following partial and total toenail removal were compared with subgroup analyses.

Secondary outcomes included the incidence of infection and the occurrence of adverse events in both groups. Visual analogue scales (VAS) (100mm) were used to measure pain in the general postoperative period and at each dressing change.

Outcome measures were assessed at each visit. This involved an assessment, as described in previous studies,[7,18] of the nail bed for the presence of granulation tissue, the level and consistency of exudate and any signs of infection. This information was recorded at each participant visit on an unvalidated outcome measures form, based on those by Subrahmanyam[7] and Schwarzentraub et al.[18]

Blinded assessments were undertaken by either the outcomes assessor or their deputy. To ensure a consistent approach and to increase inter-rater reliability, the two outcomes assessors undertook initial joint assessments following dressing removal and wound irrigation by the investigator to reduce the likelihood of observer bias. Further steps taken to reduce the likelihood of observer bias included using two layers of Jelonet on the wound bed to reduce the likelihood of an imprint on the nail bed.

Sample size

A power calculation showed a minimum of 78 subjects was required, based on the ability to detect a clinically significant difference between the interventions at a power of 80% and a significance level of 5%.

Randomisation

The study started at the first redressing appointment (two days post-surgery). This time was chosen because a haemostatic dressing is occasionally required if a minor haemorrhage occurs, and neither paraffin tulle gras or honey dressings have haemostatic properties. Furthermore, collecting baseline data on the second postoperative day gave participants more time to decide whether or not they wished to be involved in the study and increased the accessibility of the research team.

Participants were assigned to intervention groups by remote randomisation. This involved a telephone call to an independent assistant located outside of the study setting who had no prior knowledge of the participants. Random tables were used to determine intervention allocation. Following randomisation, the investigator enrolled participants into the study and completed a baseline assessment.

Masking

This was a double-blind study. Both the outcomes assessor and participants were blind to the intervention throughout. Removal and application of all dressings were performed in a treatment room with only the investigator and participant present; a screen concealed the participant's feet during dressing removal and application. All evidence of the intervention was removed and wounds were irrigated before the outcomes assessor entered the room.

Data analysis

Data were analysed using Minitab version 12. As the data did not conform to the normal distribution, non-parametric (Mann-Whitney U) tests were used to analyse average healing times and pain with statistical significance set at the 5% significance level.

Results

Fig 1 illustrates participant flow through the trial.

There were a total of 210 eligible participants, of whom 100 were recruited into the study and randomised into intervention groups: 52 into the honey group (62 operated toes) and 48 into the paraffin tulle gras group (52 operated toes). For the 62 toenails in the honey group, 21 underwent partial nail removal and 41 total nail removal. For the 52 toenails in the paraffin tulle gras group, 20 underwent partial nail removal and 32 total nail removal. (The remaining 110 patients declined to participate.)

Loss to follow-up and discontinuation of intervention were similar in both groups, resulting in 47 participants completing the trial in the honey arm and 40 in the paraffin tulle gras arm.

A total of 13/100 participants withdrew from the trial: 5/52 from the honey group (one was lost to follow-up and four withdrew because of non-concordance) and 8/48 from the paraffin tulle gras group (five were lost to follow-up and three withdrew due to non-concordance). All 13 withdrawals were excluded from the primary analyses.

Baseline demographics

Baseline analyses (Table 1) showed that:

- Age was similar in both groups

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Table 1. Baseline demographics

	Honey (n=52)	Paraffin tulle gras (n=48)
Mean age (years) (SD)	57.33 (21.3)	52.62 (23.28)
Gender (male:female)	25:27	17:31
No. who smoked	17	13
No. with diabetes	11	8
No. who underwent partial nail removal	21	20
No. who underwent total nail removal	41	32

- The gender ratio differed between groups
- Prognostic factors such as smoking status and medical history differed between groups
- Distribution of diabetes was uneven across groups.

Primary outcomes

Results for healing times are presented in Table 2. Mann-Whitney U tests showed no significant difference in healing times (p=0.32) at 95% confidence intervals (CI), with an estimated effect size of 0.4.

Subgroup analyses for participants who had partial toenail removal found that healing occurred 12.14 days earlier in the paraffin tulle gras group, which is statistically significant (p=0.01).

Subgroup analyses for participants who had total toenail removal show a faster mean healing time in the honey arm, although Mann-Whitney U tests revealed no statistically significant difference in healing times between the groups (p=0.21).

Secondary outcome measures

Due to severe digit trauma, one subject (paraffin tulle gras group) developed a postoperative infection and received antibiotics. No significant adverse events were recorded.

Mean VAS pain values were 1.60 (SD 1.22) and 1.57 (SD 1.3) in the honey and paraffin tulle gras groups respectively. Mann-Whitney U tests showed no statistically significant difference between the groups (p=0.37).

Mean pain scores experienced during dressing changes were 1.26 (SD 1.09) (honey group) and 1.23 (SD 0.84) (paraffin tulle gras group). Mann-Whitney U tests showed no statistically significant difference between the groups (p=0.56).

Discussion

This RCT found no statistically significant difference in healing times following toenail surgery between the two dressings. Subgroup analysis suggests that there was a statistically significant difference in healing times following partial nail removal favouring paraffin tulle gras. Despite a marginal advantage of honey dressings for healing times after total toenail removal, the results were not statistically significant.

Table 2. Mean healing times for primary and subgroup analyses

	Honey (n=52)	Paraffin tulle gras (n=48)
Overall	Mean: 40.30 days (SD 18.21) n=52	Mean: 39.98 days (SD 25.42) n=48
Partial nail removal	Mean: 31.76 (SD 18.8) n=21	Mean: 19.62 (SD 9.31) n=20
Total nail removal	Mean: 45.28 (SD 18.03) n=41	Mean: 52.03 (SD 21.3) n=32

The incidence of infection was low, with only one case in the paraffin tulle gras group, and no significant adverse events were observed or recorded. Both dressings were well tolerated by participants, with pain scores suggesting that minimal pain was experienced at dressing change and in the postoperative period, contradicting previous findings.[6] Analgesia was not needed before or during dressing changes.

Study limitations

There were disparities in baseline demographics. Established prognostic factors differed between groups: more smokers were assigned to the paraffin tulle gras group, and more diabetics to the honey group.

This was a pragmatic trial as it aimed to reflect a patient population typical of that undergoing toenail surgery in a hospital setting. Groups were heterogeneous with diverse demographics. Participants with stable diabetes mellitus and current smokers were included; these factors can delay wound healing, although the small numbers are unlikely to threaten the internal validity of the study.

The study's contribution to the literature

To the best of our knowledge, only eight RCTs have investigated the effect of honey on wound healing. Six trials conducted by the same researcher compared honey-impregnated gauze with a comparator dressing or tangential excision in the treatment of burns.[7,8,10,11,16,17] One trial compared honey with iodine in infected post-surgical wounds[9] and one investigated the use of honey dressings on healing times following toenail surgery.[15] Findings suggest honey does not accelerate wound healing following toenail surgery when compared with povidone-iodine and paraffin tulle gras dressings.

Conclusion

This RCT has established that there is no clinical benefit for the use of honey dressings over paraffin tulle gras dressings following toenail surgery with matrix phenolisation. ■

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