A treatment of structural seedy toe by medication and filling

Sarah Logie

Knockbain Farm, Moniack, Kirkhill, Inverness. IV5 7PL

Thesis submitted in partial consideration for the Fellowship of the Worshipful Company of Farriers. January 2017. Word count 5268 (excludes all numeracy, figure legends, references and tables)

Acknowledgements

The author would like to thank the following people for their help and advice throughout this study and for their continuing encouragement:

S. Curtis, FWCF Hon AssocRCVS
The Forge, Moulton Road, Newmarket, Suffolk CB8 8DU.

S. Moore, FWCF
Bridge Farm, Skinners Bottom, Scorrier, Redruth, Cornwall TR16 5DU.

M. Andrews MSc
Hill House, Wardlaw Road, Kirkhill, Inverness IV5 7NB.

R. Pape DipWCF
Lower Farley, Kilmorack, By Beauly, Inverness-shire IV4 7EY.

As always a tremendous thank you to my husband Dan, for standing by me throughout my studies.

Contents

Abstract.

Reasons for this study: To find a treatment method that would prevent reinfection in areas of structural seedy toe (Type 1), thereby reducing the chance of it becoming a chronic destructive condition.

Objectives: To determine whether, by debriding an area of structural seedy toe, applying a topical treatment and then filling the void in the hoof wall, further infection could be prevented.

Sample Population: 19 feet from 11 horses, with an area of structural seedy toe greater than 10 square millimetres. All horses shod by the author and managed primarily in grass turn out.

Methods: Affected feet were trimmed, debrided, given a topical treatment (Copper sulphate powder, Iodine solution or SD115) and then filled with a thermoplastic prior to being reshod. The feet in the control group were trimmed and debrided. The affected area was measured and photographed at each visit.

Hypotheses:

1) A previously infected area debrided of visible infection could be filled and re-infection prevented if a topical dressing was applied under the patch. 2) Treated hooves would return towards a solid uninfected state, quicker than untreated hooves.

Results:

The frequency of reinfection in some of the treatment groups was significantly lower than those in the untreated control group ($P < 0.05$). This resulted in those feet returning towards a solid uninfected state faster than the feet in the control group.

Conclusion and relevance:

This study showed that treating Type 1 seedy toe by medication and filling was more effective than using the traditional method of debridement and good hygiene.

The hoof recovery results were directly influenced by the frequency of infection, as reinfection required further hoof debridement, giving a longer recovery period.

The method described provides a more efficacious approach for farriers to treat Type 1 seedy toe.

Introduction.

Seedy toe has been recognised in equine feet since the 1800's (Miles, 1875). Historically treatments varied in how an area of seedy toe should be trimmed and cleaned, or whether it should be resected (Hunting, 1905). If the treatment suggested was to clean out the hollow without resection, then usually the advice was to fill the void with Stockholm tar, carbolic acid or wax (Holmes, 1928; Dollar, 1993). The general treatment advice changed when it was understood that anaerobic bacteria were involved. Debridement and regular cleaning with a topical application of an anti-bacterial dressing became an accepted treatment (Moyer, 2003; Colles, 2010). Other literature goes on to discuss various treatments that involve debridement, treatment then filling - some with medicated filling (Turner, 1998; Ross & Dyson, 2011). The author was concerned, that these filling methods, if non-medicated, do not provide continual treatment and carry the risk of re-infection. The medicated antibiotic based fillings, whilst being effective against bacteria and noted to have been 'beneficial in white line disease', would not deal with fungal invasion (Turner, 1996). The application of antibiotics could not be carried out by farriers in a day-to-day situation. The most reliable and easy to perform treatment consists of debriding the affected portion of the hoof wall and applying some topical dressing to clean the area and thereafter keeping the feet 'clean and dry' to help prevent reoccurrence. Products such as Swans Anti-bac[1] and numerous other hoof disinfectants are available, which horse owners can buy and use to treat the feet. There is only anecdotal evidence of the effectiveness of this treatment method, as it is highly dependent on individual management and facilities. The premise for this study was that once an infected area was resected and cleaned it could then be filled. The application of a topical treatment between the filler and the foot would prevent any further infection, either from remaining pathogens or from dirt ingress over the shoeing cycle. If successful, this study would remove the reliance on variable owner management and give farriers an easy to apply solution to a commonly occurring hoof problem.

[1] Swan Anti Bac hoof dressing, see manufacturers addresses.

Literature Review

The subject of fungal and bacterial invasions into the *stratum medium* of the hoof wall has been covered in books and papers since the 1800's but there was confusion regarding what the condition should be called (Miles, 1888).

In 2015 this author proposed a classification of seedy toe which would cover the different ways the condition was presented (Table 1) (Logie. 2015). The purpose was to reduce the confusion regarding the name and the presentation of the condition, and to allow effective study into the treatment of the two types of seedy toe.

TABLE 1: Seedy toe definition and classification.

Seedy toe is an invasion of pathogens into the inner layers of the hoof wall. Anaerobic bacteria and keratinophilic fungi cause separation between the *stratum medium* and *stratum internum.*	
Type 1 – Structural seedy toe	**Type 2** – Systemic seedy toe
Where an insult or weakness occurs in the hoof, through a fundamentally isolated mechanical cause.	Environmental or systemic cause. Generally poor quality hooves with brittle outer layers of horn and/or signs of blackening around the nail holes or around the white line in general. Poor shoe retention, lame or 'footie' and/or chronic laminitic.

Literature published prior to this classification refers to the condition by multiple names. The author has applied the definition of Type 1, structural seedy toe - an isolated mechanical occurrence and may only affect one foot - to all the relevant studies to avoid further confusion.

Previous literature has been mostly focused on identifying the individual bacteria and fungus present in the infected feet. Some papers have concentrated on either the presence of bacteria or fungus depending on their study, but there is a general agreement that a structural weakness allows a sulphur reducing bacterial invasion and

then a fungal infection to occur (Kuwano, 1996; Kuwano, 1998; Kempson, 2006; Wildenstein, 2003). The literature also agrees that there are numerous species of bacteria and two main genera of keratinophilic fungi; *Scedosporium* and *Pseudallescheria.* One study found that although bacteria were found in all of the horn samples only 47% of those samples showed a presence of fungal species (Kempson, 2006). In published literature there is an agreement that the majority of pathogens are anaerobic, adding to the accepted treatment of debridement and disinfection.

Limited research was found regarding specific treatments for either types of seedy toe. There are methods of soaking and using chlorine dioxide gas to treat the fungal infection but these are not methods that could be easily implemented by the farrier on their usual rounds with an unexpected case (Wildenstein, 2006). Many authors share the concern that the hoof capsule should be returned to a solid state as soon as possible and supported with a shoe, but the risk of trapping bacteria or fungal spores within the foot contraindicates this treatment (Curtis, 2006). There are numerous articles and discussions suggesting different approaches but only a few have any more than anecdotal evidence (internet sourced information). Due to the nature of the infection the majority of advice still recommends debridement and leaving open for topical dressing. One study did look at the use of antibiotic impregnated acrylic filler and concluded that the 'treatment appears promising as a therapy for white line disease' although the study was not specifically aimed at treating seedy toe (Turner, 1996). The antibiotic used in Turners study was Metronidazole[2], it was incorporated in an acrylic and used as a hoof repair. The problem with using an antibiotic, other than mounting concerns for population wide resistance, is that it would involve veterinary assistance and most cases of Type 1 seedy toe, are only discovered by the farrier once they have commenced shoeing – hence a more instant treatment would be preferable. The other concern is that a shoeing period may be from 4 weeks to 8 weeks and the topical treatment used would need to be viable throughout. The American Farriers Journal released an ebook (Lessiter, 2015) giving advice on how to deal with what it calls white line disease. Although it is a confusing paper, regarding what is and isn't white line disease, it touches on filling small infected cavities with copper sulphate and Keratex®[3] hoof putty, though states that in larger areas debridement is required.

[2] An antibiotic powder see manufacturers addresses
[3] Keratex Hoof putty see manufacturers addresses

This study did not use donkeys, but it is noted that the incidence of seedy toe (particularly type 2) in the donkey population in Britain is higher than the occurrence in their native arid habitats (Svendsen, 2008). The methods used in this study would be suitable for use on donkey feet.

Anatomy

The hoof wall consists of three layers of horn:

- The *stratum externum* (periople) is the outer most layer of horn. It is produced from papillae on the perioplic corium and is a continuation of the epidermis of the skin. It provides a protective layer to the most juvenile portion of the wall.
- The *stratum medium* (wall) makes up the main mass of the hoof wall. It is produced from the basal layer and the papillae on the coronary corium and consists of tubular, intratubular and intertubular horn. The axial portion lacks pigment and is known as the *zona alba.*
- The *stratum internum* is found on the inner surface of the *stratum medium* and consists of the primary and secondary epidermal (insensitive) lamellae. It is produced from the lower border of the coronary corium. This layer interdigitates with dermal (sensitive) lamellae that cover the parietal surface of the distal phalanx and the abaxial surfaces of the collateral cartilages, where they are contained within the hoof.

When observing the hoof from the solar surface, the interdigitation of the wall and the sole is denoted by the white line. This portion of horn is produced by the terminal papillae on the distal border of the distal phalanx (Figure 1).

The tubular horn found in the *stratum medium* consists of hard keratin cells. The tubular horn found in the *stratum medium* consists of hard keratin cells. These cells contain long chain fibrous protein molecules (desmosomes), held strongly together by disulphide bonds between the amino acids methionine and cysteine. Methionine and cysteine contain sulphur, which is required in the final stages of keratinisation allowing the horn to harden fully as the cells die. Areas of horn such as the frog and the white line have less horn tubules, and therefore less disulphide bonds. This means they are not as strong, but they have a higher number of lipids and sulphydryl groups (proteins containing sulphur) which provide elasticity to those areas (Pollitt, 1998). The horn tubules are found in four distinct layers of density within the depth of the hoof wall. The abaxial layer has the highest density of tubules and less density in each subsequent layer (Figure 2 & 3). This configuration of tubules means that the abaxial layer of the *stratum medium* is the hardest and most rigid and the horn gets softer and more

flexible as they get deeper into the hoof (Reilly, 1998). This graduation of horn hardness and flexibility allows stress to be smoothly transferred across the wall, onto the lamellae and then the skeleton. Intertubular horn is found between the tubules, it is produced from basal cells on the *stratum germinativum* (basal layer), between the coronary papillae. The cells of the intertubular horn are produced at ninety degrees to the direction of the horn tubules, creating a matrix of continually hardening keratin around the tubules (Goodman, 2008). This configuration gives the horn greater strength in all directions and more resistance to cracks (Bertram & Gosline, 1986).

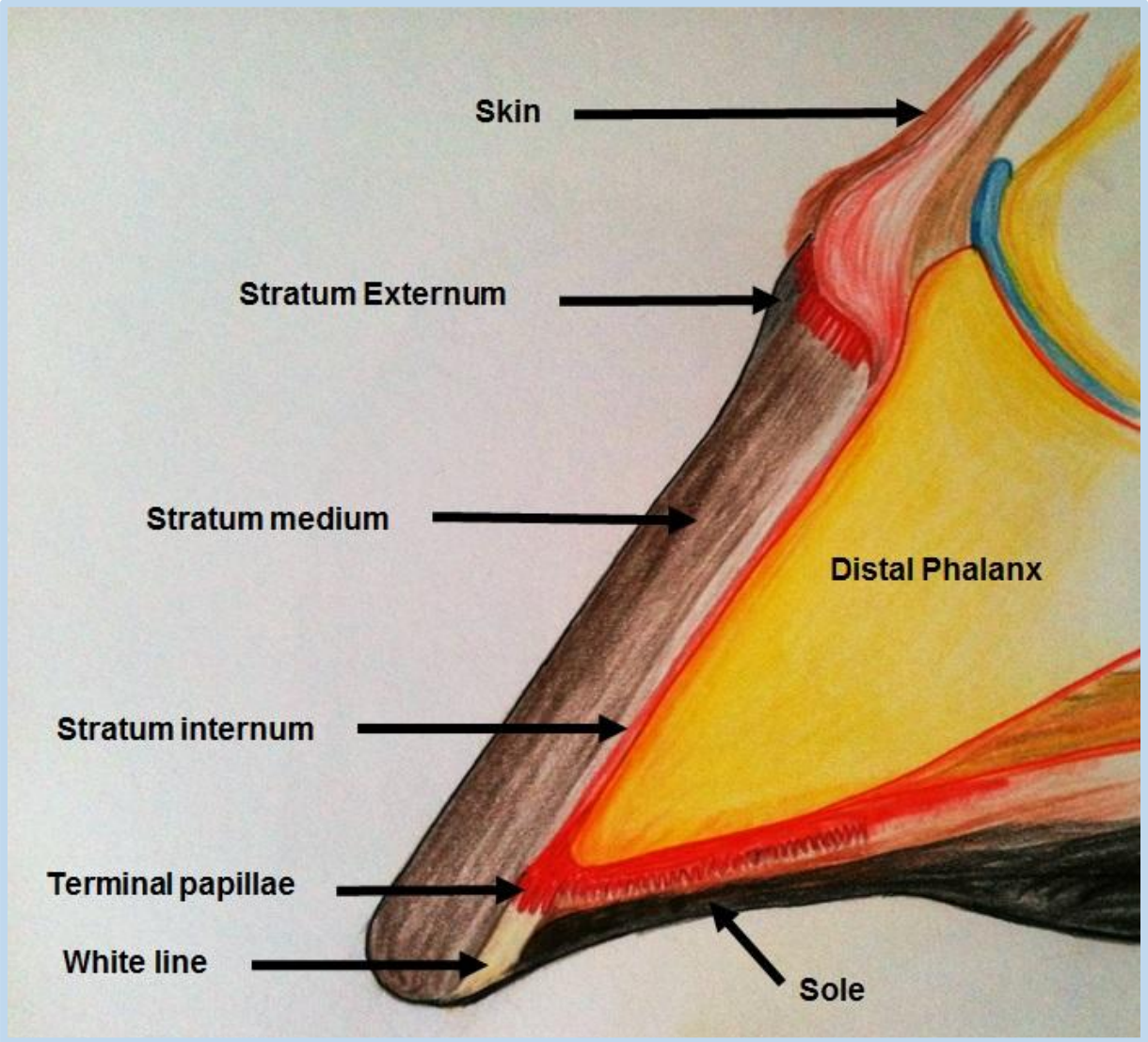


Figure 1: The production of the white line from the terminal papillae on distal phalanx.

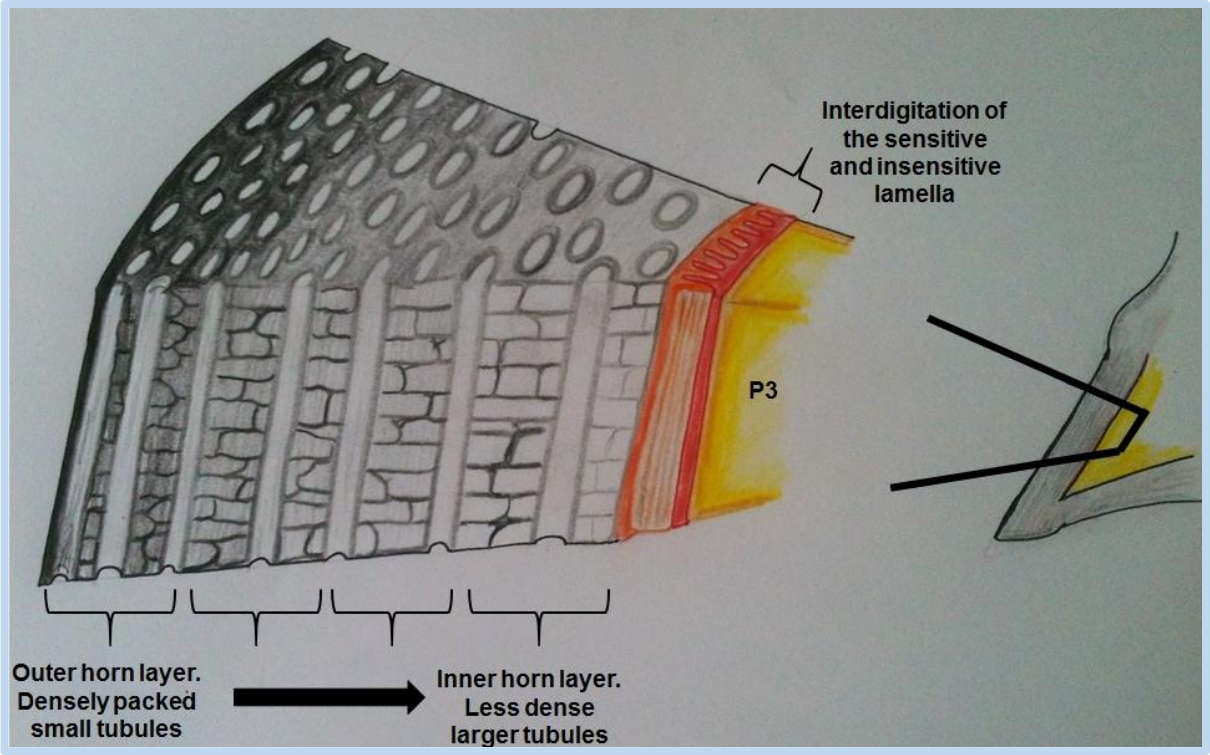


Figure 2: Schematic diagram of the hoof wall illustrating the varying tubule densities across the *stratum medium* of the hoof wall.

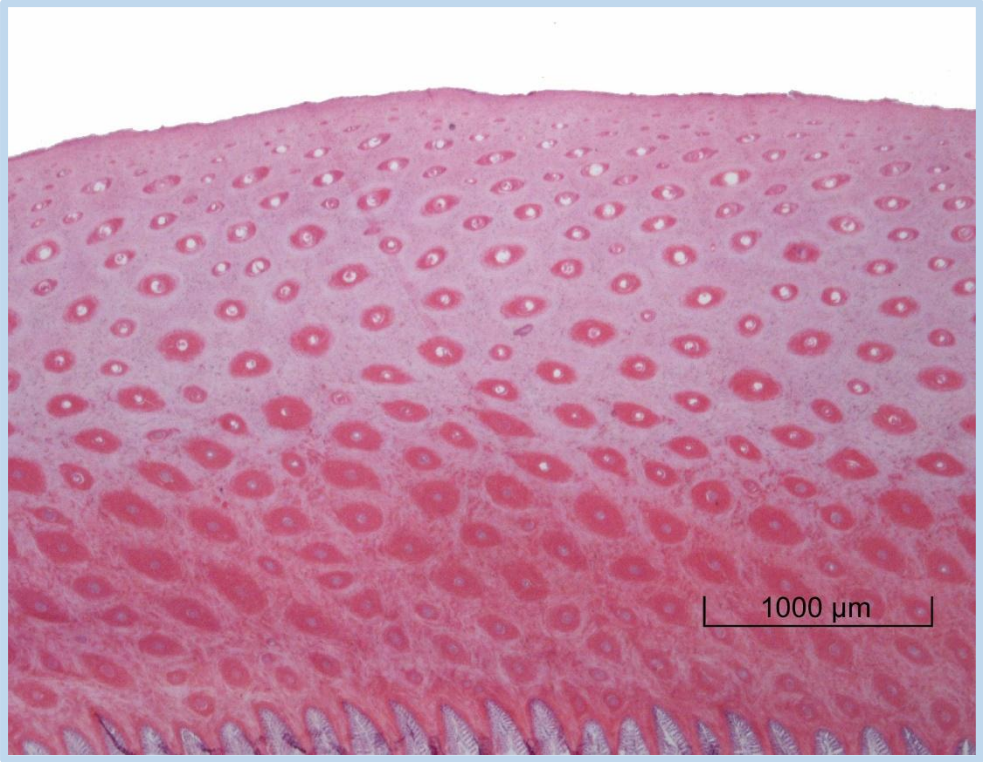


Figure 3: Transverse section of the *stratum medium* as seen under the microscope (Curtis – Corrective Farriery Volume 2, with kind permission.)

Organisms involved

There have been various studies into the type of bacteria and fungi that are found in infected hoof walls. Each study identifies a different number and type of these pathogens. However, most papers do agree that the main fungal species found are the genus *Scedosporium* which are a known soil fungus found worldwide, and also *Pseudallescheria boydii* (Kuwano, 1998). By contrast to the number of fungi there are numerous different bacteria found in affected hooves (Kempson, 2006)(Figure 4).

A seedy toe infection is keratinolytic, disintegration of keratin, and is characterised by the damage and the subsequent separation of the *stratum medium* from the *stratum internum*. The pioneer organisms are sulphur reducing bacteria which will cause destruction of the sulphur bonds between the keratin molecules (Kempson, 2006). The horn degradation is furthered by opportunistic keratinophilic species of fungi and bacteria. These organisms digest the elements of keratin, leaving the wall weakened or absent depending on the severity of the condition (Moyer, 2003).

The anatomy of the wall and the greater availabilty of keratin within the inner most layers of the *stratum medium* explains the location of the infection. Keratinophilic fungi have a reduced ability to digest and use lipids as an energy source, so they do not actually digest the white line itself (Kunert, 2000).

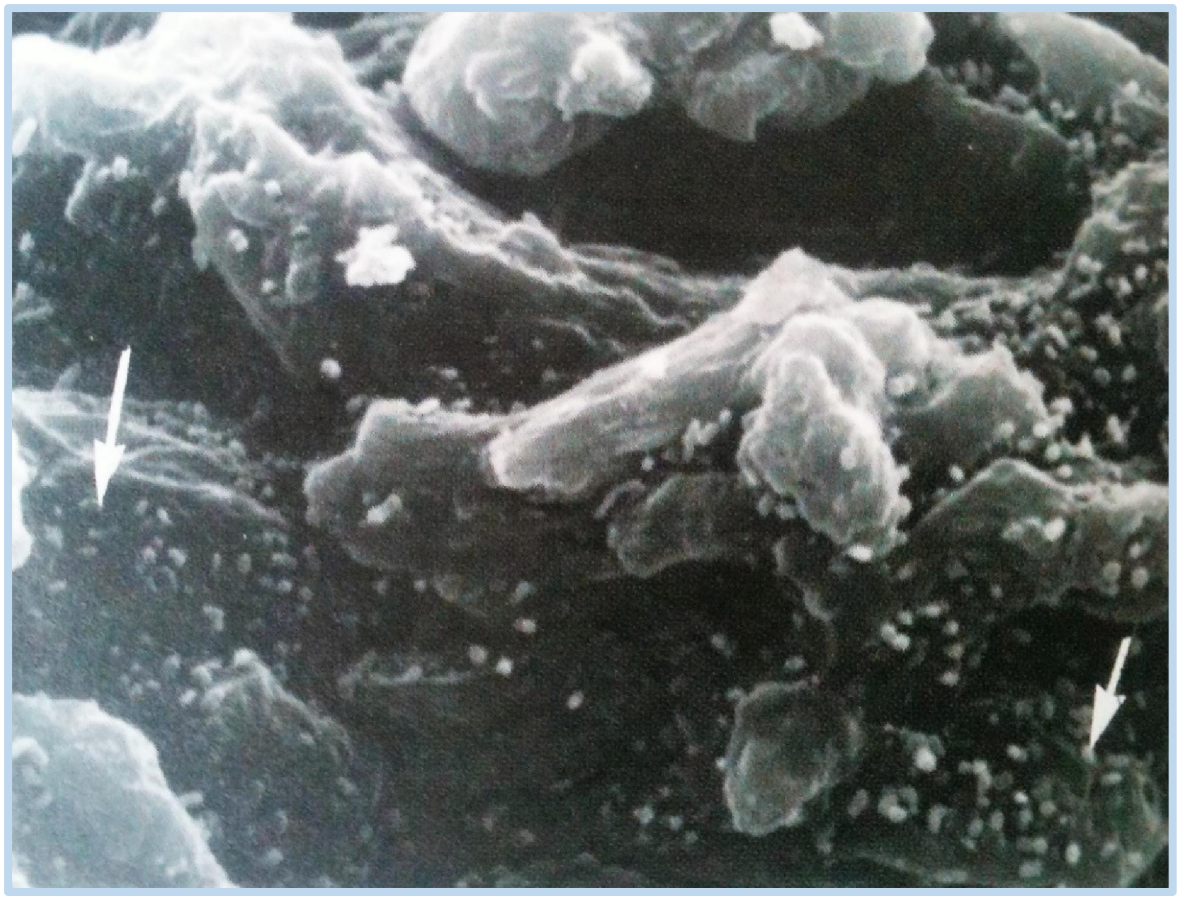


Figure 4. An electron microscopic image showing bacteria on horn cells (bacteria arrowed) (Curtis – Corrective Farriery Volume 2. with kind permission).

Reasons for the study

The reason for the study was to find the most efficacious method of treating feet with structural seedy toe (Logie, 2015). These are feet that have persistent areas of infection, but do not resolve satisfactorily with traditional treatments of general cleanliness and a dry environment. Often the application of these treatments fails due to lack of consistent application and poor management.

Aims

The purpose of this study was: 1) to find a treatment that would prevent reinfection in areas of structural seedy toe, reducing the chance of it becoming a chronic and destructive condition; 2) to establish whether a treatment of seedy toe (Type 1) by medication and filling carried out 'in the field' can be effective (Logie, 2015); 3) to remove the reliance on the horse owner to manage the condition between shoeings; 4) to improve hoof renewal times and reduce the time the horse has a compromised hoof capsule.

Hypotheses

The hypotheses were: 1) a previously infected area, free from bacteria and fungi, could be filled and reinfection prevented if a topical dressing was applied under the patch, 2) treated feet would return towards a solid, uninfected state, faster than the control feet.

For the statistical analysis the null hypothesis (H_0) was that there is no difference between the groups.

Objectives

The objective of this study was to measure whether by effective cleaning and medication prior to rebuilding the wall, further infection can be prevented thus allowing quicker renewal of a healthy and stable hoof capsule.

Study design, materials and method

This study looked at using three different topical treatments under one type of filler against a control of the accepted treatment of debridement and owner controlled management.

The study compared a treatment group of 19 feet with visible areas of structural seedy toe >10mm^2. All horses were in similar management, and primarily in grass turn out.

All horses were shod by the author, at an interval suitable to their hoof growth and workload. At each subsequent shoeing the area was measured and treated as per their allotted group. All owners had agreed to the treatments, signed a consent form and the data was kept securely to maintain confidentiality.

Treatment groups: The hoof was trimmed and then debrided until the visible extent of the disease was exposed. The area was then photographed, measured, medicated and filled. Measurements were taken from the coronary hairline to the highest point of the debrided area (in line with the laminae), the widest point of the debrided area (at the base) and the height of the debrided area from the ground surface (in line with the laminae) (Figure 5). The area the horse was stood on was always hard and brushed clean. Initial treatment consisted of mechanical removal of affected horn using disinfected farrier tools, then the resected area was prepared for filling by creating 'keys' for the thermoplastic to lock into, and then was treated with the randomly chosen product for that horse[4]. Once treated the cavity was repaired in a prescribed method with thermoplastic[5], the shoe was nailed on, finished off, the patch was cooled[6] to harden it then sealed with acrylic glue[7] (Figure 6). The shod foot was loaded before the plastic was hardened, to help prevent sole pressure. To reduce the risk of infection or abscesses, if any sensitive tissues were present the area was not filled until the areas had keratinised and become unresponsive to direct pressure (Appendix A). The type of filler used was chosen as it was moisture tolerant, non-exothermic and easy to remove which was necessary at each shoeing. Exothermic materials can cause

[4] Treatment groups: Iodine solution, Copper (II) Sulphate Pentahydate Fine Powder, Nollan silver product (Antimicrobial Hoof Spray SD115)
[5] Imprint Hoof Repair and Shoe Extension Material
[6] Imprint Shoe Freezer
[7] Imprint Structural Adhesive

problems if the resected area is close to sensitive tissue, and may also react with the topical treatments (Curtis, 2006).

Copper (II) Sulphate Pentahydate Fine Powder[8] group: The treatment was applied by dipping the wet malleable thermoplastic into the powder immediately prior to moulding into the hoof.

Iodine solution group: The solution was applied in excess prior to application of the thermoplastic.

Nollan silver product - Antimicrobial Hoof Spray SD115 group: The gel was applied and allowed to dry prior to application of the thermoplastic.

At each subsequent visit, the presence of visible infection was recorded and the size of the area resected was measured.

Welfare precautions in the treatment groups: If the hoof wall in the infection area of any foot was noted to have deteriorated after two consecutive treatments or no significant progress was seen after 4 treatments then the treatment method was changed to prevent potential harm occurring to the horse through a further loss of hoof wall.

The overall management for the treatment groups was not altered in any way during treatment.

Control group: This group were identified as having hooves affected by structural seedy toe and were treated purely by debridement and exposure of the infected area. The affected areas of the feet were measured as per the treatment group and not medicated at the time or filled with a repair material (Figure 7). The owners of these horses were asked to keep the feet ‘clean and dry’ between visits and treat daily with whichever ‘over the counter’ topical dressing (e.g. Swans® Anti-bac) they had access to. The owners were not asked to use the same treatment as used in the other groups as the purpose was to replicate the current treatment methods which tend to be those available from the saddlery supplies. Such treatments were not considered to be effective or long lasting enough to use under the patches in the other groups. One owner changed the management of the horse to prolonged stabling during treatment.

[8] For safety data sheets see Appendix I - M

The work was photographed at each stage. The forms used to obtain permission and record data are shown in Appendix B.

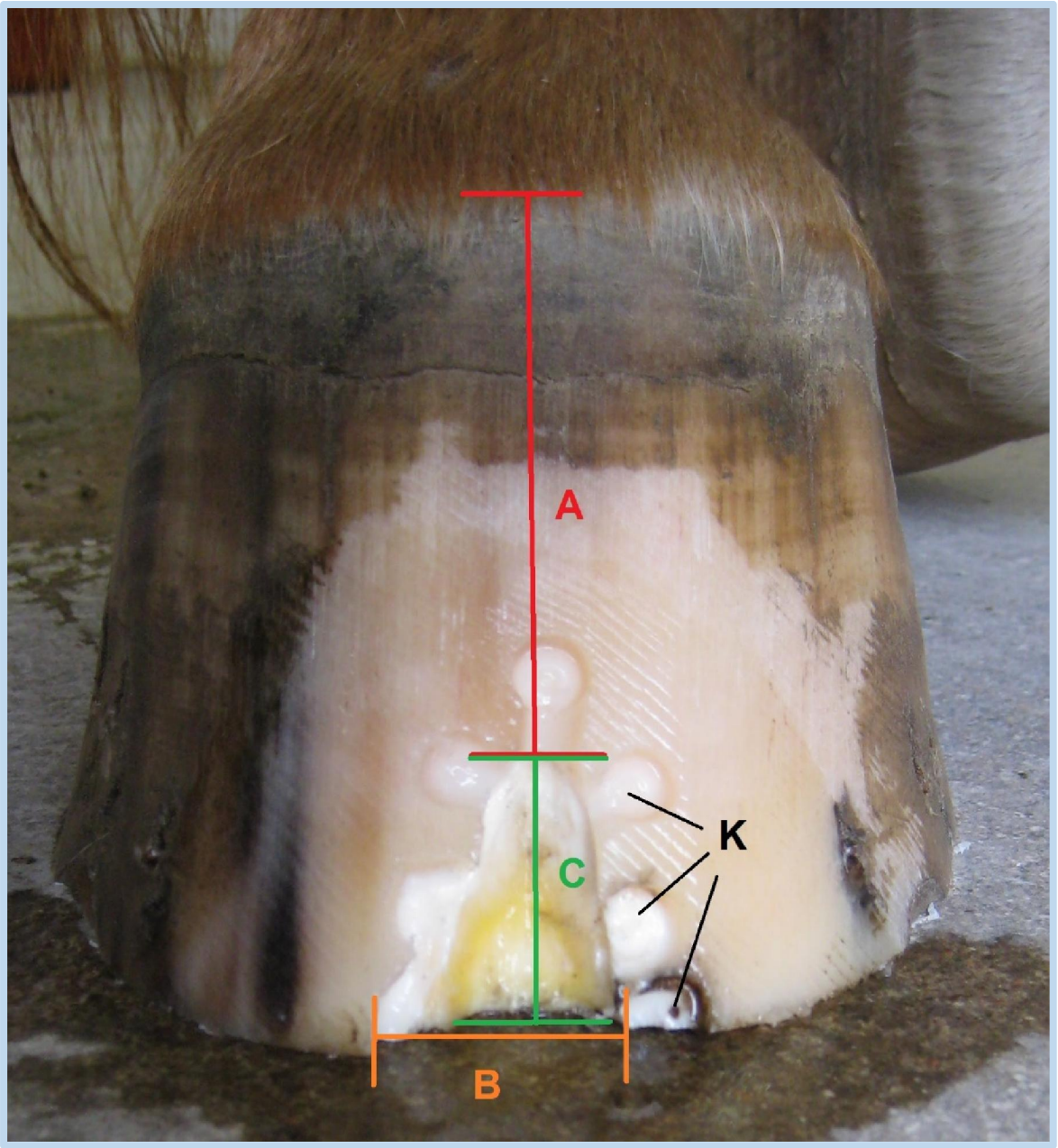


Figure 5: Measuring the affected area and showing the ‘keys’ for the patch.

A: Hairline to the highest point of the debrided area (in line with the laminae).

B: The widest point of the debrided area.

C: Highest point of the debrided area from the ground surface (in line with the laminae).

K: Keying points for the plastic to lock into the hoof wall.

Figure 6: Finished iodine treatment foot

Figure 7: Control group foot, resected and left open for owner to apply topical treatment daily.

Statistical Analysis

Data was collated using Microsoft® Excel[9]. Results were compiled in chart form using Excel.

The area reduction per day was calculated as below:

$$Area\ reduction\ per\ day = \frac{(Original\ area - Final\ area)}{days\ treatment\ used}$$

The probability of there being a difference in the re-infection rates between the four groups was tested using Chi Squared. The table was then partitioned to find where any difference between the groups lay. The standard statistical methods of Chi squared testing and its partition tests are described in Appendix C. Measurements of; affected area, rate of area reduction, and the change in distance between the hairline and the highest point of debridement, were taken. The different groups were then analysed with standard parametric methods (distribution, mean, 95% confidence limits) and the probability of there being any difference between the groups tested by analysis of variance (ANOVA) if the data warranted. For all analyses values of $P<0.05$ were considered statistically significant.

[9] Microsoft Excel: Microsoft UK PLC; Microsoft Campus, Reading Thames Valley Park Reading RG6 1WG

Study Data.

All the individual data collected is recorded in Appendix D. The summary of the group data is shown in Table 2. The start and finish area of each horse is shown in Table 3.

Table 2: Group data.

Group	Number of feet	Initial Area infected (mm^2) (range)	Days treated (range)	Number of feet returned to solid	Feet moved from another group	Feet moved to other group.	Feet with on going treatment at end of study
Control	5	150 - 1400	119- 282	0	0	2	5
Iodine Solution	4	96 - 434	168 - 282	3	0	0	0 (*1 sold)
SD115	4	176 - 875	55 - 323	1	1	3	0
$CuSO_4$ Powder	6	294.5 - 1250	77 - 288	4	4	0	2

Table 3: A summary of each horse, their treatment group and the start and finish debrided areas.

Group	Horse	Start Area (mm^2)	Finish area (mm^2)
Control	7	475	294.5
Control	12	150	370
Control	14	350	337.5
Control	15	240	240
Control	16	1400	630
$CuSO_4$	4	323	0
$CuSO_4$	11	1250	0
$CuSO_4$	12C	391	127.5
$CuSO_4$	5B	805	0
$CuSO_4$	6B	350	348
$CuSO_4$	7B	294.5	0
Iodine	1	434	0
Iodine	2	350	0
Iodine	3	312.5	0
Iodine	9	96	96
SD115	5	875	805
SD115	6	176	350
SD115	8	220	0
SD115	12B	370	391

Reinfection results

Clear differences showed between the groups (Table 4) with the control group having the highest rate of reinfection, followed by the SD115 gel, the Iodine solution then the copper sulphate powder having the lowest rate of reinfection (Figure 8).

Table 4: Infection rates between groups

	Visit 1	**Visit 2**	**Visit 3**	**Visit 4**	**Visit 5**	**Visit 6**	**Visit 7**	**Visit 8**	
Days treatment	**0**	**27 - 63**	**77 - 126**	**126 - 189**	**168 - 252**	**232 - 267**	**282 - 288**	**323**	**Sum**
Control infected	5	4	5	4	3	1	0	0	22
Control non infected	0	1	0	1	0	0	1	0	3
Iodine infected	4	2	1	1	1	1	0	0	10
Iodine non infected	0	2	3	3	2	0	1	1	12
CuSO4 infected	5	0	0	0	0	0	0	0	5
CuSO4 non infected	1	6	6	4	4	2	1	0	24
SD115 infected	4	3	3	2	3	1	1	0	17
SD115 non infected	0	1	1	1	0	1	1	0	5

The frequency of reinfection in each group was calculated by the number of occurances of infection, divided by the number of visits multiplied by 100 to give a percentage.

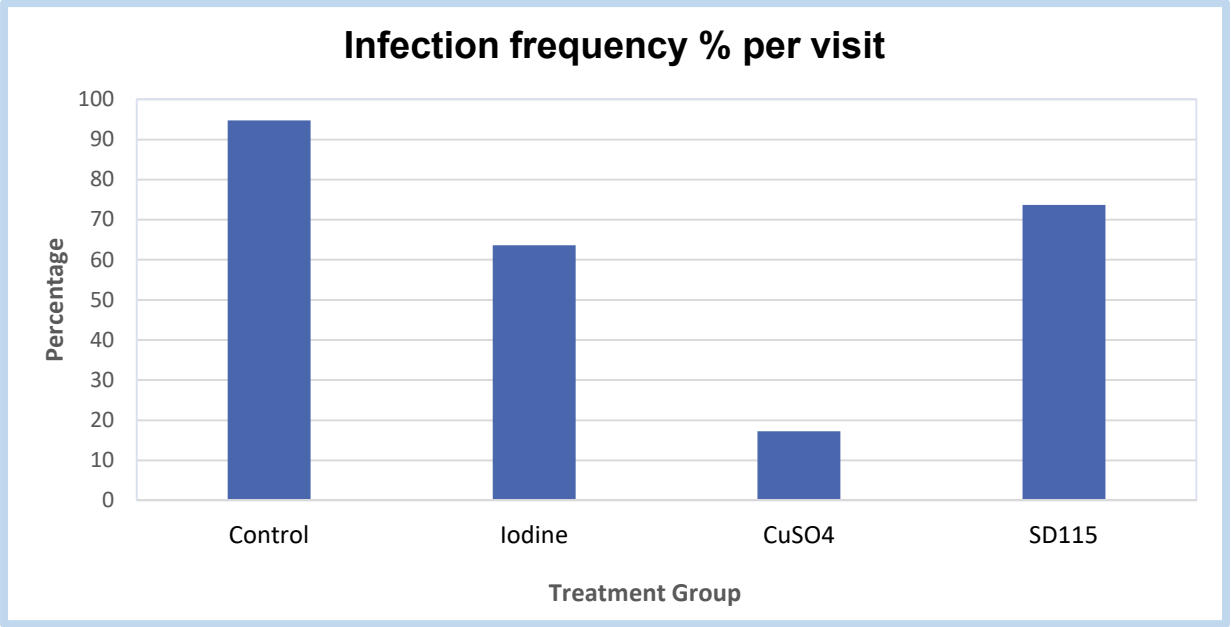


Figure 8. Clear differences showed between the treatment groups, there was far less reinfection found in the horses in the $CuSO_4$ group than those in the other groups.

The Chi squared test results

Complete workings are shown in Appendix C.

The results were tested to $P<0.05$, and were also significant with P values at 0.001 and a Chi squared value of 32.94.

With 3 degrees of freedom and $\alpha = 0.001$, the critical value is 16.27 so H_o (i.e. there is no difference between the different variables) can be rejected and we conclude that there is a significant difference between the groups.

The partitions showed:

Chi squared comparing Control to SD115: H_o stands (no difference between the treatments and this also shows the patch does not make a difference).

Chi squared comparing Control+SD115 vs iodine: H_o rejected (there is a difference between the treatments).

Chi squared comparing Control+SD115+iodine vs $CuSO_4$: H_o rejected.

Hoof recovery results

Each horse has an individual hoof growth rate and this is their maximum possible area reduction rate. This growth rate can not be altered by a treatment applied to the distal border of the hoof wall. If visual infection is present and further debridement is required the area reduction rate is slowed down.

The graphs show, the reduction in the area affected over the time they were treated. The presence of visible infection is denoted by a black data point.

As the horses were all started at a separate time, and some were changed into a different treatment group, their data lines appear to stop mid graph, this was due to the study being completed before they had grown out, although their treatment continued.

The results show a consistent level of improvement for the copper sulphate powder (Figure 9) and Iodine solution groups (Figure 10).

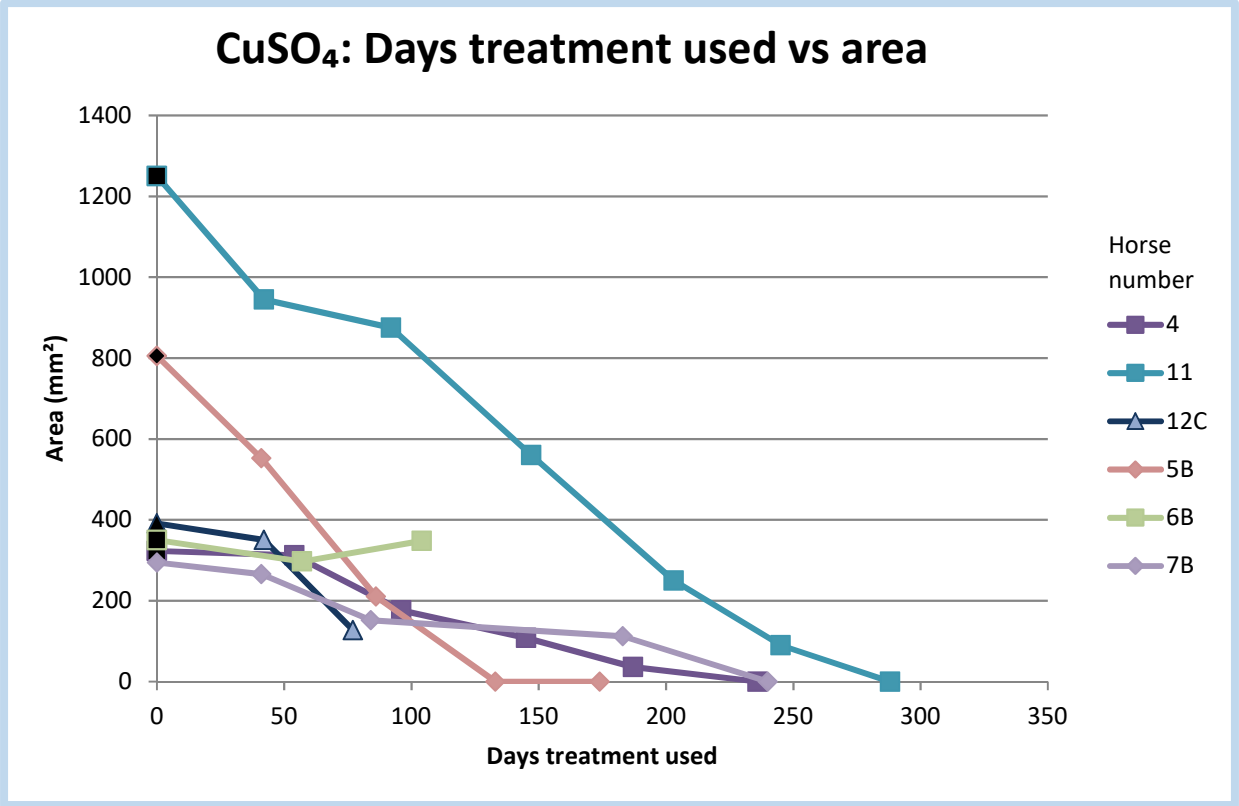


Figure 9: Copper Sulphate group. The results of the individual horses are shown here. Only one horse (horse 6B) had an occurrence that caused the affected area to be debrided back to its original size, this was due to the loss of the shoe, some hoof wall, and the patch whilst living in very muddy conditions. Some of the lines seem to stop but this is because the study was completed before the next visit, although their treatment continued. All the other horses had a continual decrease in the size of the debrided area.

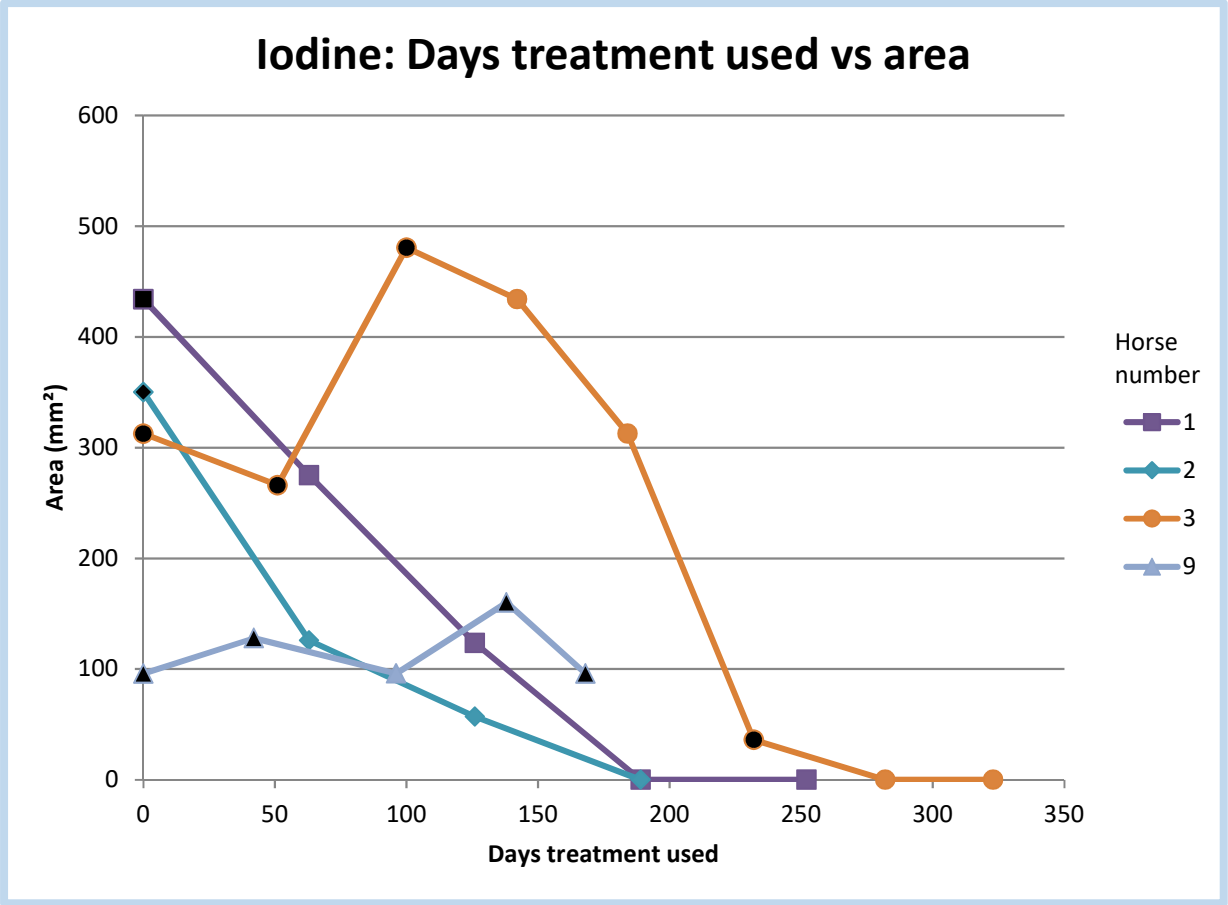


Figure 10: Iodine solution group. Of the four horses in this group horse 1 & 2 showed consistent improvement but horse 3 had visible signs of infection (data points in black show infection was visible) present at the third visit and horse 9 had visible signs of infection at visit 2 and visit 4. This reinfection caused further debridement to be necessary, and therefore reduces the recovery rate.

The SD115 group showed marginal change in the feet (Figure 11).

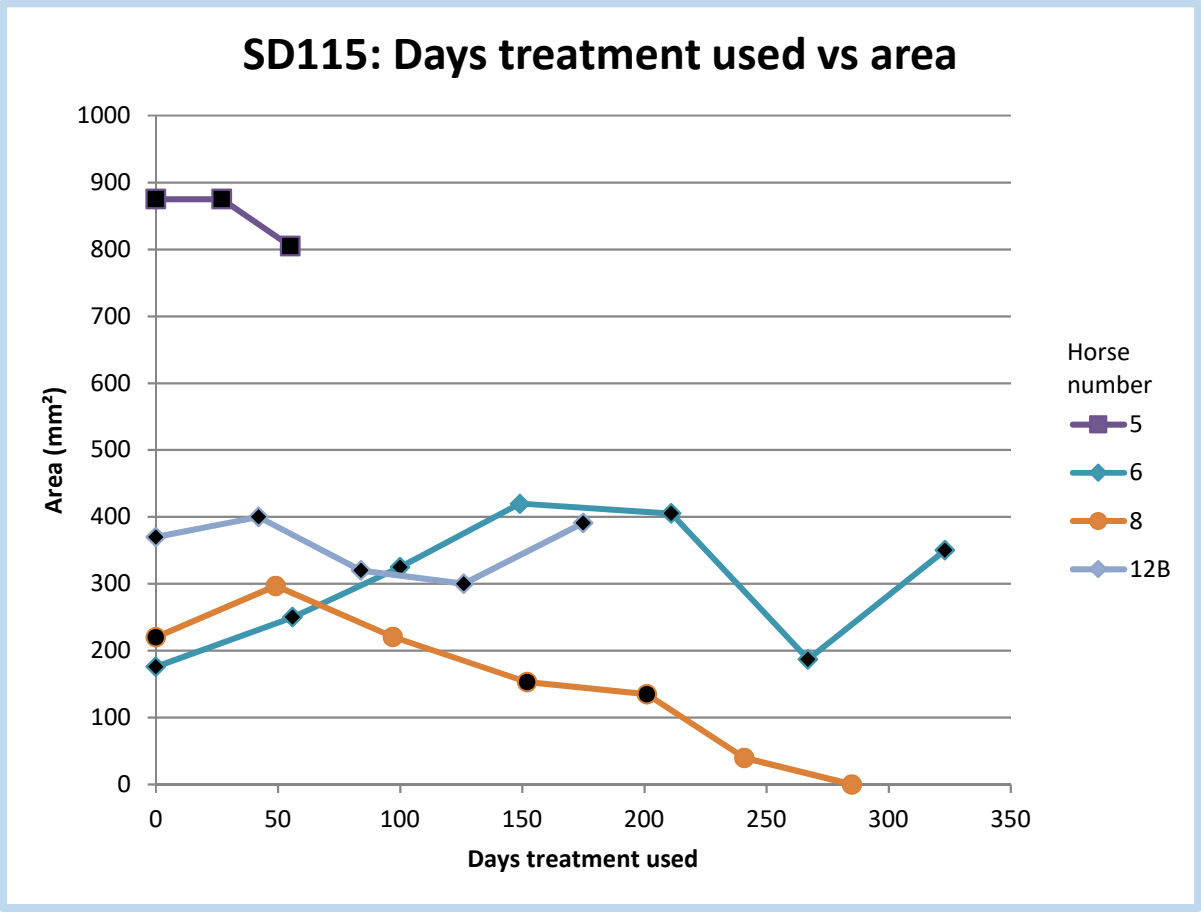


Figure 11: SD115 group. The horses in this group showed regular occurrences of reinfection (data point colour black to show visible sign of infection) this showed that even if a reduction in the size of the debrided area occurred it had still reduced less than the hoof had grown.

The control group showed a majority of the feet had either an increase in the size of the debrided area or minimal reduction in area. This was due to the high occurrence of visible infection (Figure 12).

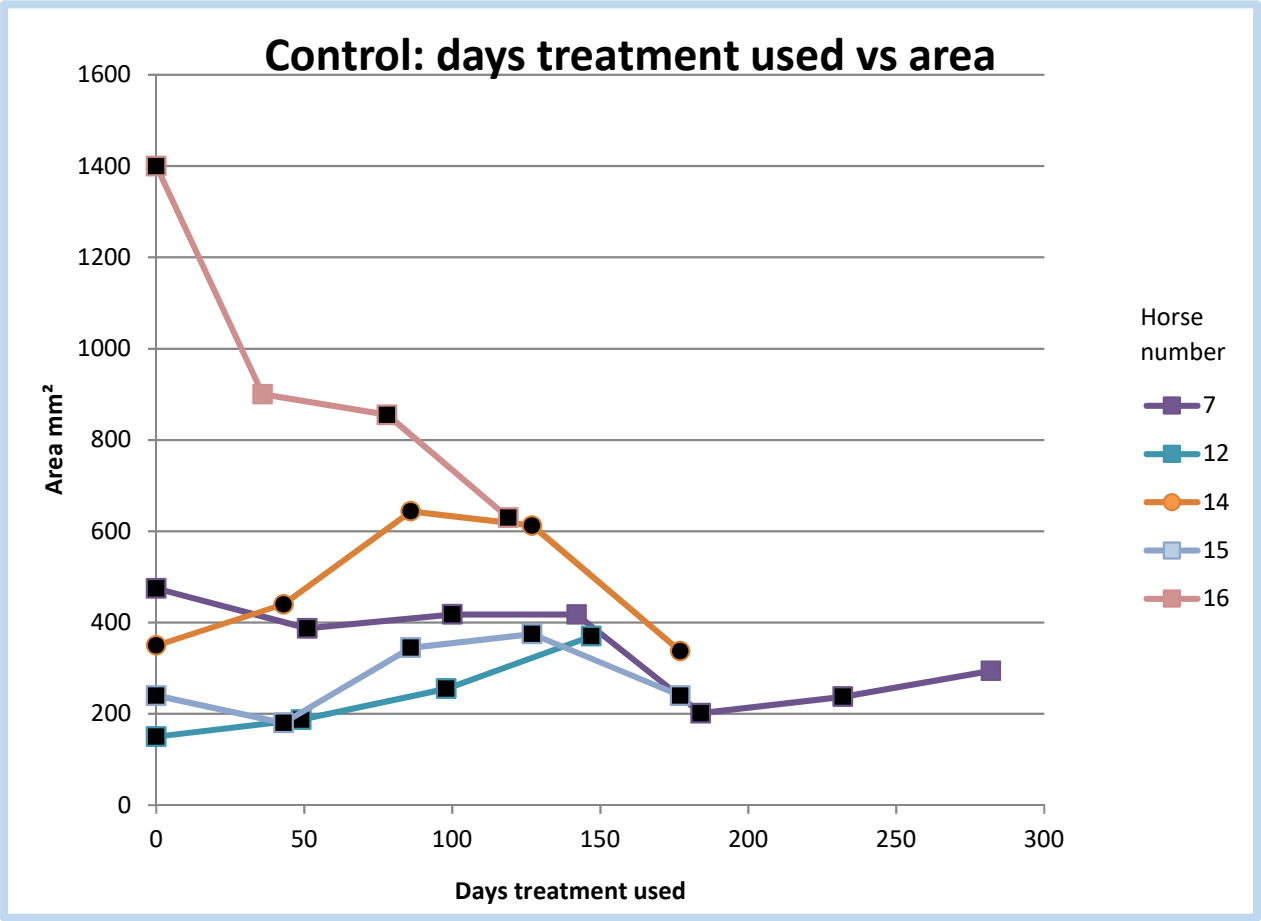


Figure 12: Control group. The horses in this group showed regular occurrences of reinfection (data point colour black to show visible sign of infection). The feet of two horses (7&16) showed some improvement. Horse 7 was placed into a treatment group due to only a 50% improvement over 232 days, during which time it regressed on two separate visits. Horse 16 had a complete change in management to very restricted turnout and twice daily topical application of 'Swans Anti-bac', this substantial financial and time commitment by the owner did however show that reinfection can be prevented with rigorous management.

Combined hoof recovery results

The mean area reduction per day was calculated across the individuals in the groups and then as the group. The different rates were compared to see the most effective method of regaining a solid hoof capsule. No further analyses was carried out on the area reduction, it was clear that no significant differences between the groups could be shown by statistical testing (Table 5)(Figure 13).

The hairline distance was measured as it allowed a mean hairline growth rate, per day per group, to be analysed (Table 5)(Appendix E). The group with least re-infection should have the faster growth rates, even allowing for differences in individual growth rates and the starting area of the debridement. The mean change in hairline height (mm/day) is shown in Figure 14, the addition of the error bars show that the copper sulphate group was statistically significant different from the control and SD115 groups (Error bars use ±95% CI).

Table 5: Mean Area reduction rates and mean hairline distance growth rates for the four groups.

		Control	**$CuSO_4$**	**Iodine**	**SD115**
	number	5	6	4	4
Area reduction	mean	1.137	2.738	1.314	0.346
	Standard deviation	3.085	2.261	1.004	0.825
	$^{+/-}$ 95% Confidence limits	2.704	1.810	0.984	0.808
Hairline distance	mean	0.049	0.155	0.1	0.015
	standard deviation	0.067	0.061	0.077	0.055
	$^{+/-}$ 95% Confidence limits	0.058	0.049	0.075	0.054

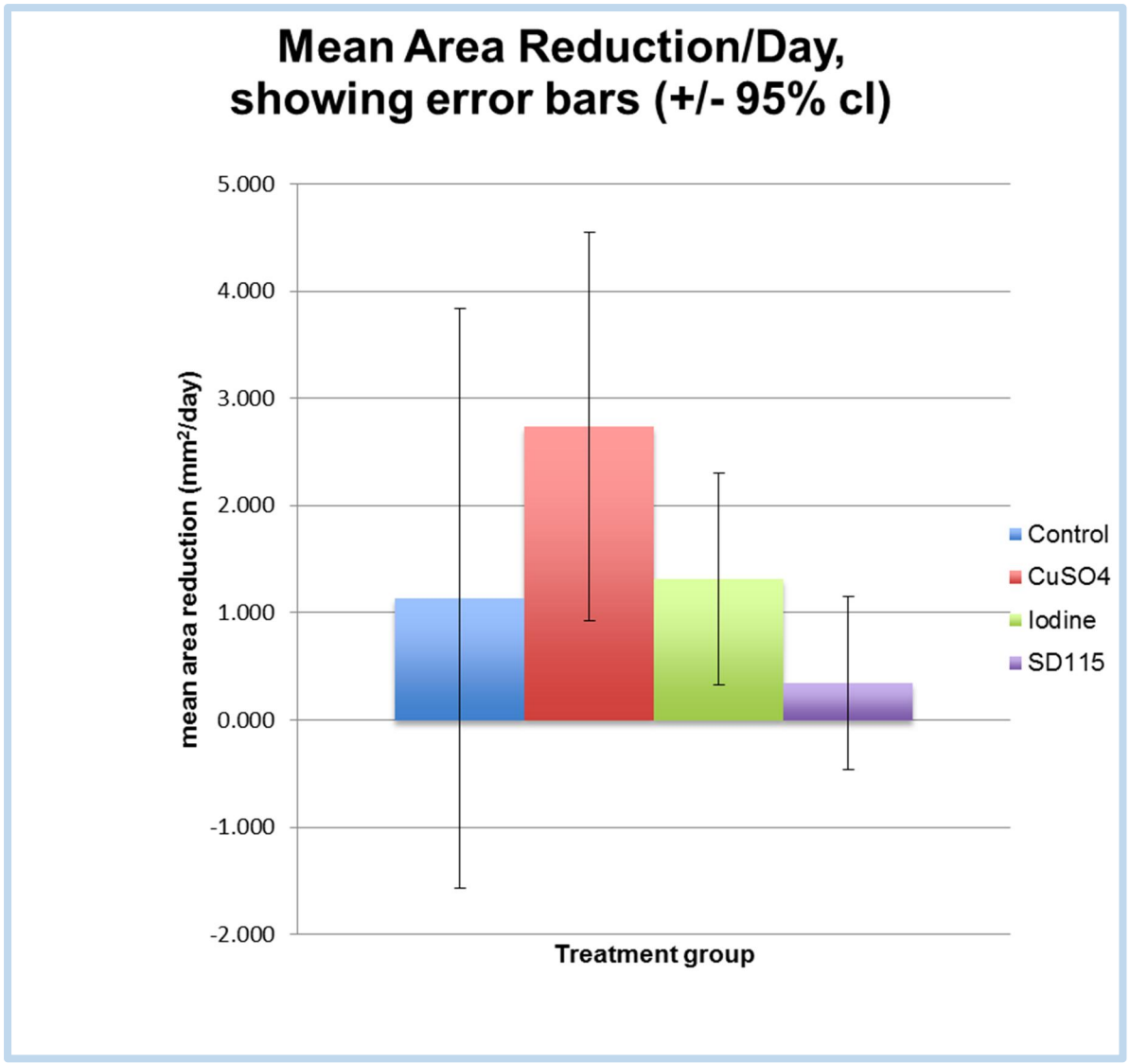


Figure 13: Comparing the mean area reduction between the groups showed that there was no statistically significant difference.

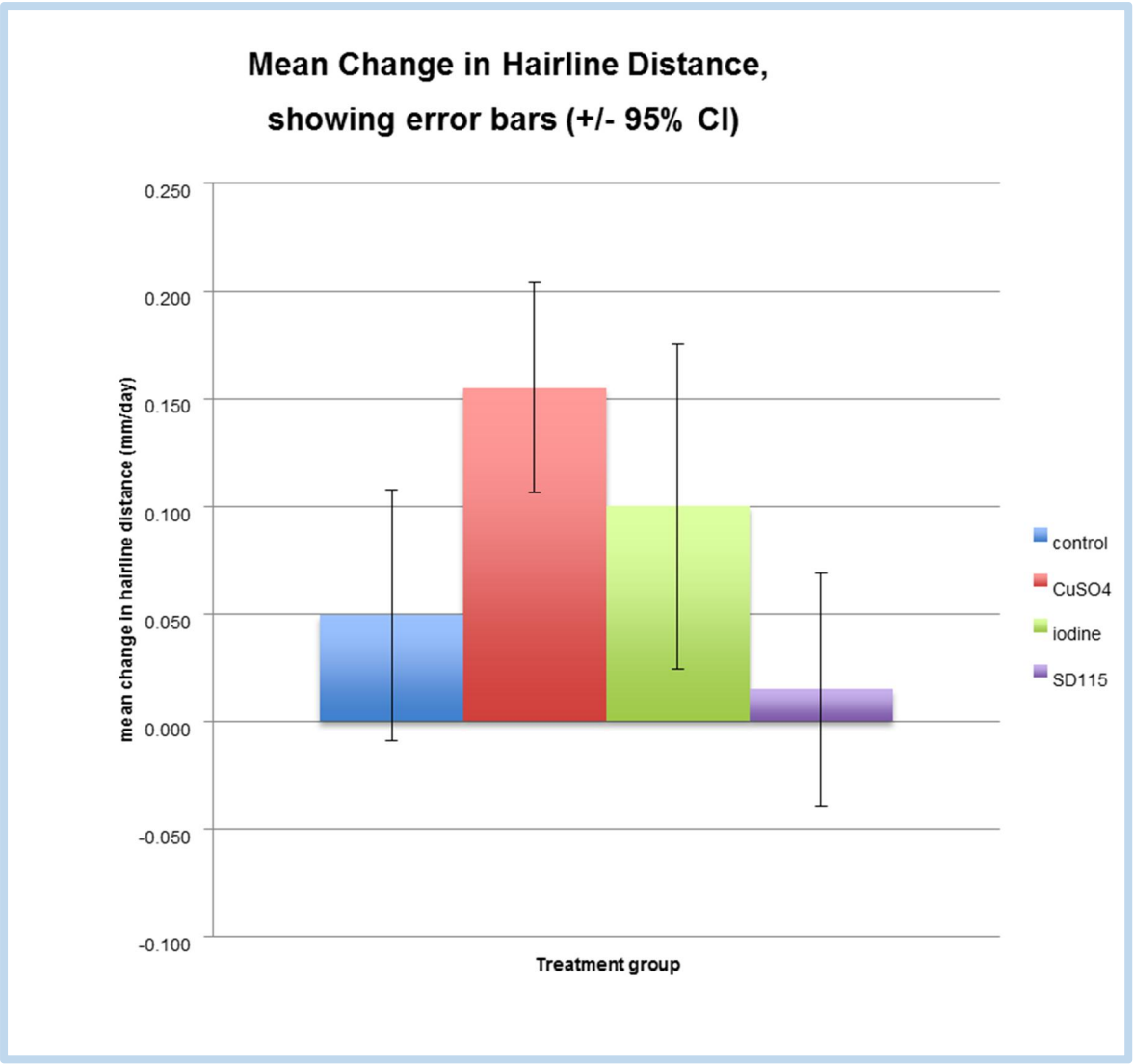


Figure 14: The group with the lowest frequency of reinfection also has the highest mean change in hairline distance. This graph shows the $CuSO_4$ group is statistically different from the control and SD115 groups (the error bars do not overlap). The individual group graphs are shown in Appendix F.

Horse 12 - Treatment history

Horse 12 was used in three treatment groups as it continued to worsen in the first two groups. The graph below shows a comparison between the effectiveness of the different treatments and it should be noted the management did not change throughout (Figure 18). The black data dots show that infection was present at that visit.

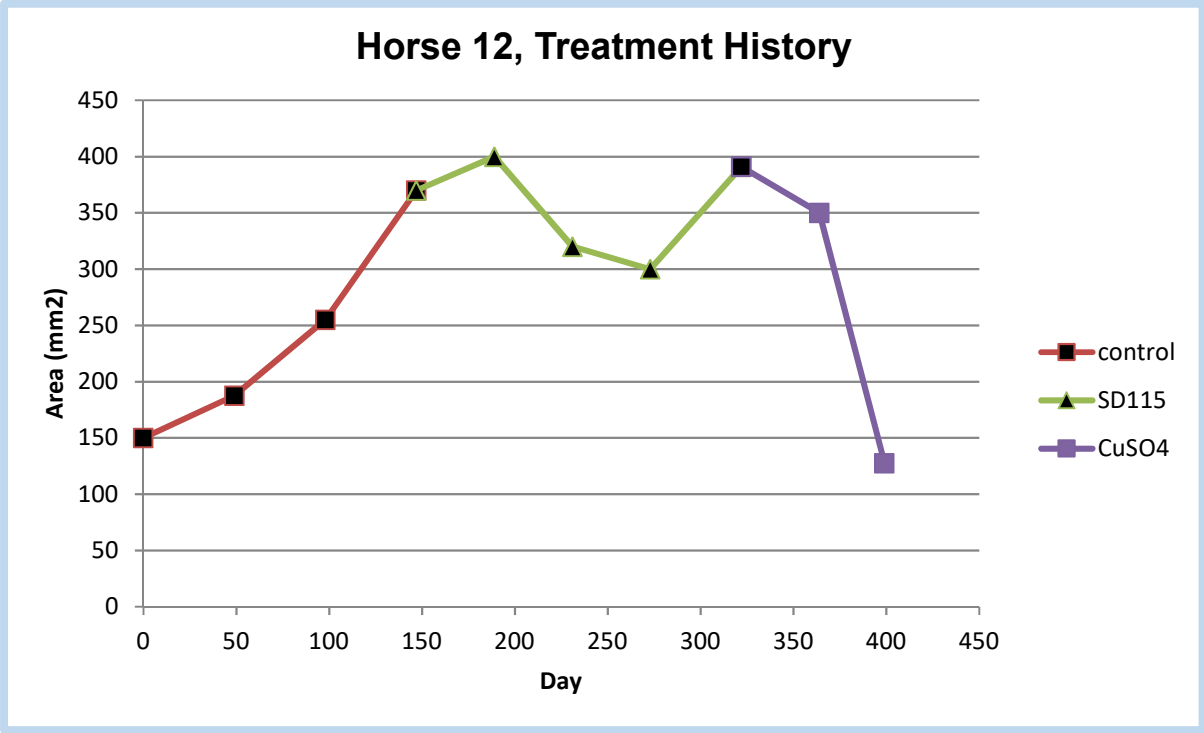


Figure 18. Horse 12 treatment history; Horse 12 showed a constant presence of visible infection and an increase in the size of the debrided area whilst in the control group. It was then transferred to the SD115 group where it showed improvement for one visit, although infection was visible. Further visits showed the debrided area increased in size again. The horse was then transferred to the copper sulphate group as per the pre-determined welfare precautions. No further sign of visual infection was noted and the debrided area decreased in size. The Hairline distance graph for Horse 12 is shown in Appendix G.

Summary of results

- The results show that the frequency of reinfection was significantly different between the four groups ($P<0.05$). (It should be noted results were also still significant at $P <0.001$)

- Chi squared partition testing showed that there was no difference between the SD115 and control groups ($P>0.05$) and therefore it was not the application of the patch that was making the difference.

- Chi squared partition testing showed that the application of copper sulphate or iodine solution significantly reduced the frequency of reinfection; ($P<0.05$) allowing a hoof to re-grow and return to a solid structure.

- The application of copper sulphate powder or iodine solution increased the rate at which the hoof could be returned to a solid state, although this was not statistically significant when observing the area reduction against the days of treatment.

- The hairline distance (growth/day/group) showed a significant difference between the copper sulphate group and the control and SD115 groups (Anova, $P<0.05$). As already shown the horses in that group had the lowest frequency of re-infection so all the growth they produced could be left without further debridement.

Discussion

The aim of this study was find the most effective method for a farrier to treat Type 1 seedy toe in the field, at short notice. The traditional method was reliant on too many variables, such as environment and management, which are beyond the control of the farrier. Farriers are often frustrated by the worsening of a Type 1 seedy toe case despite clear instructions to the equine manager. Literature agrees about the anaerobic nature of the pathogens involved the accepted treatment of debridement and disinfection is logical, but only if a clean environment can be maintained. This was supported by the one horse in the control group which progressed with good management. However, if the facilities are not available it is an almost impossible management task to maintain the correct conditions for healthy regrowth of horn without further infection. This study shows that the hoof recovery rates are directly influenced by the occurrence of reinfection, as that requires further debridement.

The method of hoof repair with the addition of an anti-pathogen treatment, used in this study, would ensure farriers are in control of the outcome. A study using the application of antibiotics had shown the theory worked (Turner, 1996), but it was not a treatment that could be carried out by the farrier. Turner's study used the addition of an antibiotic powder to an acrylic filler then hoof defects were filled then left to grow out. The paper did not describe the living conditions of the horses used but concluded that it was a viable treatment within the restrictions of using acrylics (curing times were affected by the powder and the hoof must be dry to carry out the repair).

As the current advice is for debridement and exposure for the affected portion of wall, it can be assumed that the application of a patch, without an effective treatment underneath, is contraindicated (Curtis, 2006). Anecdotal evidence has shown that in such conditions the infection can deteriorate very rapidly.

Wildensteins' study discussed the causes of the infection and touched on the confusion regarding naming the condition but didn't go into any depth regarding treatment beyond debridement and sterilization. The classification of Type 1 and Type 2 seedy toe can clear up the confusion he discussed and allowed the treatment to be focused on. It is clear that preventing reinfection is key to resolving Type 1 seedy toe (Wildenstein, 2003).

This study shows that the application of the copper sulphate powder under the patch can produce the fastest recovery in an individual case. The significant results showed that reinfection can be prevented between treatments, with an easy, cost effective patching method that is already widely used within farriery. This method allows the farrier to control the treatment, and the owner is no longer required to change the horses management. On a microscopic level it has been shown that copper sulphate can damage horn cells (Kempson, 1998). However its use is less damaging to the hoof integrity than the infection, as far more horn cells are lost during debridement.

Although the method used in this study was successful in the shod horse, the unshod horse or donkey poses another challenge. In the author's experience the unshod horse often suffers from a bacterial invasion that requires shoeing, to regain hoof capsule strength and stability.

Donkey feet are at high risk of bacterial invasion in wet conditions due to the stratum medium having a different structure to a horse. The tubules are larger, less dense and lack the zonal layers present in a horse, which means in wet conditions (UK) they are more deformable than those of a horse and less able to withstand invasion from pathogens. If the treatment used in this study can be adapted to provide an unshod application, it could help maintain the integrity of donkey hooves which would otherwise be compromised.

Recorded changes in the environment giving milder & wetter conditions means that more attention should be given to what may appear to be minor invasions on the bottom of the horses feet. Proactive methods, such as used in this study, that are easy and inexpensive to apply, and which are beneficial to overall hoof health should be encouraged.

Anecdotal evidence suggests indiscriminate breeding of horses, across the breeds, has had an impact on the genetic quality of the hooves that farriers are dealing with. Combine that with a less experienced owner, the greater control the farrier has of a treatment, the more likely it is that they will maintain feet.

More research is needed to ensure that the application of a different hoof repair material does not have a detrimental effect with a certain treatment, or a combination of treatment and filler be unsuitable: for example, acrylic hoof repair will not bond with iodine solution present.

There are many different hoof disinfectant products available and that means that various combinations should not be recommended until it can be shown that no detrimental chemical reaction would occur. The treatments in this study were selected due to their established uses; Iodine solution is used during surgical procedures to disinfect wounds. Copper and its derivatives is understood to be advantageous against infection – for example the NHS are discussing the reintroduction of copper handles and bed rails to limit the spread of bacterial infection. Silver is being used to prevent infection whilst in contact with sensitive tissue on burns dressings, but is recognised to have a shorter span of effectiveness.

Further research is required into finding a treatment that is as effective as copper sulphate but safe to use near sensitive tissue.

The ability to provide a reliable treatment which will regain hoof stability, reduced the presence of dirt and bacteria (by filling) prevent reinfection (by medicating) without the need for a change in environment or management has to be a preferable option. This study has proved that this method is a viable treatment for use every day, in the field, by farriers.

Limitations of study

This was a relatively small study with only 19 feet involved. Increasing the number of feet and sampling from different geographical areas would give a better indication as to the efficiency of the method. There was also a reliance on visual inspection to confirm the presence of infection. Access to laboratory testing of horn samples to confirm the presence of bacteria or fungus would have been preferable, but it would have been impractical given the nature of the study due to it being carried out during routine field visits.

The author was not convinced, during visual inspection, that all the feet in the control group were treated daily, but this demonstrated the difficulties of relying on owner management for this condition.

The study used treatments chosen by the author for their merits as established medical applications.

It should be noted that the copper sulphate treatment was limited, as a strong irritant it could not be applied near sensitive structures.

The author would not advocate leaving the medicated patch on for more than one shoeing, as regular observation of the condition should occur to prevent a worsening of the condition.

This study is limited to treating Type 1 seedy toe cases, as the farrier can remove or treat the cause of the invasion (imbalance, cracks, gravel runs etc.), and then treat the infection. Type 2 seedy toe cases will require further input from the equine manager to help isolate and remove the cause, (e.g. incorrect nutrition, poor environment, chronic laminitis etc.) Type 2 cases will not resolve through farriery alone.

Conclusion

Type 1 seedy toe poses a risk to the strength and integrity of the hoof capsule. When it becomes extensive it can cause lameness and a challenge to the farrier.

If treated in a proactive method, even extensive areas of compromised hoof can be restored. By using a topical treatment under a thermo-plastic filler, the risk of reinfection is greatly reduced. This speeds up the restoration time for the hoof capsule and removes the reliance on third party management.

In this study, copper sulphate was the most effective topical treatment to prevent reinfection between shoeing visits, but there are other treatments that need to be trialled.

Further research is required but this study has shown that there is a viable more effective alternative to present methods.

Manufacturers addresses

Swans Anti-Bac hoof dressing, SWAN PORTAFORGE LTD. Units 1 & 2 Gamma Orchard Trading Estate Toddington Glos, GL54 5EB United Kingdom

Metronidazole powder, Manav Drugs,Plot No.146 B/147, Sursez , Road No. 3, Diamond Park, Dist-Surat. Sachin-394230, Gujarat, INDIA

Keratex Hoofcare - Penleigh Irving Ltd, Little Penleigh Farm, 25 Fairwood Road, Dilton Marsh, Westbury, Wiltshire. BA13 3SN

Farrier tools – hoof cutters, half round cutters, knives, rasp, and drill with 10mm wood drill bit (point ground off and fitted with depth gauge at 4mm)

Hoof Repair and Shoe Extension Material, Imprint Structural Adhesive & Imprint Shoe Freezer, Poynton Ltd Town Forge, High Street, Malmesbury, Wiltshire. SN16 9AT UK

Nolla SD115, Mr. Juha-Pekka Pöyry, M. Sci. Research and Development Director, VIIKINKAARI 6 00790 Helsinki, Finland

Copper Sulphate $CuSO_4$, Stromsholm Limited, Wood Court, Chesney Wold, Bleak Hall, Milton Keynes. MK6 1NE

Microsoft excel®, Microsoft Corporation, One Microsoft way, Redmond WA 98052-6399, USA.

REFERENCES

Bertram, J., Gosline. J., 1986. Fracture toughness design in horse hoof keratin. *Journal of Experimental Biology,* 125(1), pp. 29-47.

Colles, C., Ware,R., 2010. *The priciples of farriery.* London: J.A.Allen.

Curtis, S., 2006. *Corrective Farriery.* Volume 2 ed. s.l.:Newmarket Farrier Consultancy.

Dollar, A., Wheatley,A., 1993. *A handbook of horseshoeing.* Wisconsin: Centaur Forge Ltd.

Goodman, A., Haggis. L., 2008. Reginal variation in the flexural properties of the equine hoof wall. *Comparative Exercise Physiology,* 5(3-4), pp. 161-168.

Holmes, C., 1928. *The principles and practice of horse-shoeing.* Leeds: The farriers' journal publishing Co. Ltd.

Hunting, W., 1905. *The art of horse shoeing.* 3 ed. London: H & W Brown.

Kempson, S. et al., 1998. *Slurry, formalin and copper sulphate: The effect on the claw horn..* Lucerne, Switzerland, s.n., pp. 216-217.

Kempson, S., Robb, R., 2006. *Corrective farriery.* 1 ed. s.l.:Newmarket Farrier Consultancy.

Kunert, J., 2000. Physiology of keratinophilic fungi.. *Revista Iberoamericana de Micologia,* Volume 1, pp. 77-85.

Kuwano, A. et al., 1998. Onychomycosis in white line disease in horses: pathology, mycology and clinical features. *Equine Veterinary Journal,* Volume 30, pp. 27-35.

Lessiter, F., 2015. White Line Disease: Different Approaches To An Old Problem. *American Farriers Journal,* 29 October.

Logie, S., 2015. White Line disease or seedy toe. *Forge,* 2(6), pp. 28-31.

Miles.W.J., 1888. *Modern Practical Farriery: To which is Added, An Essay on the Diseases and Management of Cattle and Pigs (by J.I. Lupton).* London. Glasow. & Edinburgh: William Mackenzie.

Moyer, W., 2003. Hoof wall defects: chronic hoof wall separations and hoof wall cracks. *Veterinary Clinics of North America: Equine Practice ,* 19(2), pp. 463-477.

Pollitt, C., 1998. The anatomy and physiology of the hoof wall. *Equine Veterinary Education,* 10(S4), pp. 3-10.

Reilly, J. et al., 1998. Tubule density of the stratum medium of horse hoof. *Equine Veterinary Journal,* 30(S26), pp. 4-9.

Ross, M., Dyson, S., 2011. *Diagnosis and management of lameness in the horse.* 2nd ed. St. Louis: Elsevier Saunders.

Svendsen, E., 2008. *The professional handbook of the donkey.* 4th ed. Yatesbury: Whittet books.

Turner, T., 1998. White line disease. *Equine veterinary Journal,* 10(S4), pp. 73-76.

Turner, T. A., 1996. Use of antibiotic-impregnated hoof repair material for the treatment of hoof wall separation. A promising new treatment. *Proceedings American Association equine Practitioners,* Volume 42, pp. 205-207.

Wildenstein, M., 2003. *A detailed examination of white line disease.* s.l.:s.n.

Wildenstein, M., 2006. *Corrective farriery.* 2 ed. Newmarket: Newmarket farriery consultancy.

Appendices

Appendix A

Case Study: Horse 11, Copper sulphate group.

Horse contracted structural seedy toe after an abscess in the lateral toe quarter of the off hind.

Visit 1: Due to the sensitive nature of the proximal aspect of the debrided area the area was left accessible for daily treatment by the owner and packed with cotton wool (Figure 1).

Visit 2: The cotton wool was keeping the majority of the dirt out of the area (Figure 2) The area was no longer sensitive so it was filled as normal (Figure 3).

Figure 1: Area sensitive to thumb pressure left exposed.

Figure 2: Cotton wool keeping the majority of the mud out of the area.

Figure 3: Horse no longer sensitive to thumb pressure, treated and filled as normal.

Appendix B

A STUDY TO ASSESS DIFFERENT FARRIERY TREATMENTS OF NON-SENSITIVE WHITE LINE DISEASE.

Study ref:

Client

Name.

Address.

Contact number.

Vet.

Consent given Y/N signed:

Horse

Name:

Age: Height:

Breed: Sex:

Colour:

Conformation:

Any predisposing conditions: (Laminitis cracks etc.)

Diet information:

Exercise regime:

Management :(i.e. stabling/turnout hours and ground conditions)

Feet

Colour of feet concerned. Black White Mix

Affected feet: Near Fore Off fore Near Hind Off Hind

Shod/Unshod

Take photos before starting.
Description of degree of infection. (size of debrided area mm)

Width =

Height =

Hairline to top of debrided area =

Take photos
Treatment method used.

Take photos

Filling notes

Take photos

Initial Treatment date:

Next appointment:

Follow up treatment of case study

Study ref:

Date:

Treatment method:

Take photo
Visual condition of the patch: (Have the edges lifted?)

Removal of filled area: (Had dirt infiltrated?)

Take photo
Has there been any further visual infection?

Repeat treatment method (any comments)

Measure growth in mm

Hairline to top of resected area =

Width mm =

Height mm =

Take photo
Any notes/comments:

Fill area and take photo
Next appointment.

Appendix C

To Calculate Chi Squared (χ^2)

Treatment (r)		infected (c)	Non-infected (c)	Totals R
Control	n	22	3	25
	E	13.77	11.22	
Iodine	n	10	12	22
	E	12.12	9.88	
CuSO4	n	5	24	29
	E	15.98	13.02	
SD115	n	17	5	22
	E	12.12	9.88	
Totals	C	54	44	98

Variable r		Categories c 1	2	Combined
Control	n	n_{11}	n_{12}	R_1
	E	E_{11}	E_{12}	
SD115	n	n_{21}	n_{22}	R_2
	E	E_{21}	E_{22}	
Iodine	n	n_{31}	n_{32}	R_3
	E	E_{31}	E_{32}	
CuSO4	n	n_{41}	n_{42}	R_4
	E	E_{41}	E_{42}	
Totals		C_1	C_2	N

i = variable (row), j = category (column) n = observed frequency.

If H_o is true (i.e. there is no difference between the different variables) Then the expected frequency (E) in each cell of the table is: $E_{ij} = (R_iC_j)/N$

The null hypothesis (H_o) that the groups are sampled from the same population may be tested by:

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} (n_{ij}^2 / E_{ij}) - N$$

Where:

n_{ij} = observed number of cases categorized in the ith row of the jth column

E_{ij} = number of cases expected in the ith row of the jth column when H_o is true.

Using: $E_{ij} = (R_iC_j)/N$ then the "expected" frequencies for the table can be computed:

e.g. Control, infected $E_{11} = (R_1xC_1)/N = (25x54)/98 = 13.77$

Control, non –infected $E_{12} = (R_1xC_2)/N = (25x44)/98 = 11.22$

.

.

SD115 non-infected $E_{42} = (R_4xC_2)/N = (22x44)/98 = 9.88$

And:

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} (n_{ij}^2/E_{ij}) - N$$

$$\chi^2 = (n_{11}^2/E_{11})+(n_{12}^2/E_{12})+(n_{21}^2/E_{21})+(n_{22}^2/E_{22}) + (n_{31}^2/E_{31})+(n_{32}^2/E_{32}) + (n_{41}^2/E_{41}) + (n_{42}^2/E_{42}) – N$$

$$\chi^2 = (22^2/13.77) + (3^2/11.22) +(10^2/12.12) + (12^2/9.88) + (5^2/15.98) + (24^2/13.02) + (17^2/12.12) + (5^2/9.88) – 98$$

$$\chi^2 = 32.94$$

Degrees of Freedom (df) = (r-1)(c-1), where r is the number of rows (variables) and c is the number of columns (categories).

df = (4-1)(2-1) = 3

If an observed value of $\chi 2$ is equal to, or greater than, the value given in the table "Critical values of the chi-square distribution" for a particular level of significance, at a particular df, then H_o may be rejected at that level of significance.

With df =3 and α = 0.001, the critical value is 16.27 so H_o can be rejected and we conclude that there is a difference between the groups.

To find where the difference lies:

Partition the contingency table into independent 2x2 sub-tables and analyse each of them. Contingency tables may be partitioned into as many 2 x 2 sub-tables are there are degrees of freedom in the original table.

Each of the tables has 1df. To test the independence between the two groups in such tables the Chi-squared test must be modified to reflect the fact that these are sub-tables obtained from a larger table and, hence, reflect characteristics of the entire sample.

For general r x 2 tables, r-1 partitions may be formed. The general equation for the t^{th} partition of an r x 2 table is:

$$\chi^2_t = \frac{N^2 \left(n_{t+1,2} \sum_{i=1}^{t} n_{i1} - n_{t+1,1} \sum_{i=1}^{t} n_{i2}\right)^2}{C_1 C_2 R_{t+1} \left(\sum_{i=1}^{t} R_i\right) \left(\sum_{i=1}^{t+1} R_i\right)} \qquad t = 1,2,\ldots\ldots r-1$$

Critical values of χ^2 for a table with 3 partitions decided a posteriori (i.e. once the data has been collected) and a required probability of 0.05 would be α/p which equals 0.05/3 = 0.0167

To partition the table:

Variable r	Categories c 1	2	Combined
A	n_{11}	n_{12}	R_1
B	n_{21}	n_{22}	R_2
C	n_{31}	n_{32}	R_3
D	n_{41}	n_{42}	R_4
Totals	C_1	C_2	N

First Partition

n_{11}	n_{12}	R_1
n_{21}	n_{22}	R_2
C_1	C_2	N

$$x^2{}_1 = \frac{N^2(n_{22}n_{11} - n_{21}n_{12})^2}{C_1C_2R_2R_1(R_1 + R_2)}$$

	infected	non-infected	
control	22	3	25
SD115	17	5	22
	54	44	98

First partition. Comparing Control to SD115

$$x^2 1 = \frac{98^2(5 * 22 - 17 * 3)^2}{54 * 44 * 22 * 25(25 + 22)}$$

$$\boldsymbol{x^2 1 = 0.544}$$

Chi squared control vs SD115, with 1 df and p=0.01 the critical value of chi-squared is 6.64, so **Ho stands**

Second Partition

n_{11} + n_{21}	n_{12} + n_{22}	R_1 + R_2
n_{31}	n_{32}	R_3
C_1	C_2	N

$$x^2{}_2 = \frac{N^2[n_{32}(n_{11} + n_{21}) - n_{31}(n_{12} + n_{21})]^2}{C_1C_2R_3(R_1 + R_2)(R_1 + R_2 + R_3)}$$

	infected	non-infected	
Control + SD115	22 + 17	3 + 5	25 + 22
Iodine	10	12	22
	54	44	98

Second partition. Comparing Control and SD115 to Iodine

$$x^2 2 = \frac{98^2[12(22+17) - 10(3+5)]^2}{54 * 44 * 22(25+22)(25+22+22)}$$

$$\boldsymbol{x^2 2 = 8.529}$$

Chi squared Control+SD115 vs iodine, with 1 df and p=0.01 the critical value of chi-squared is 6.64, so **Ho rejected**

<u>Third Partition</u>

n_{11} + n_{21} + n_{31}	n_{12} + n_{22} + n_{32}	R_1 + R_2 + R_3
n_{41}	n_{42}	R_4
C_1	C_2	N

$$\frac{x^2{}_4 = N^2[n_{42}(n_{11}+n_{21}+n_{31}) - n_{41}(n_{12}+n_{22}+n_{32})]^2}{C_1 C_2 R_4 (R_1+R_2+R_3)(R_1+R_2+R_3+R_4)}$$

	infected	non-infected	
control	22	3	25
	+	+	+
iodine	17	5	22
	+	+	+
SD115	10	12	22
$CuSO_4$	5	24	29
	54	44	98

Third partition. Comparing Control and SD115 and Iodine to $CuSO_4$

$$x^2 3 = \frac{98^2[24(22+17+10) - 15(3+5+12)]^2}{54 * 44 * 29(25+22+22)(25+22+22+29)}$$

$$\boldsymbol{x^2 3 = 23.86\ 5}$$

Chi squared Control+SD115+iodine vs CuSO4, with 1 df and p=0.01 the critical value of chi-squared is 6.64, **so Ho rejected**

Appendix D

Horse	Date	Days horse treated	Days treatment used	Treatment Group	Infection visible no = 0 Yes = 1	Hairline distance mm	Width mm	Height mm	Area Infected mm²	Area infected %	Height reduction mm	Near/ Off	Colour of foot
7	18.06.13	0	0	control	1	55	25	38	475	100.00	0	OF	Black
7	08.08.13	51	51	control	1	62	25	31	387.5	81.58	7	OF	Black
7	26.09.13	100	100	control	1	55.5	22	38	418	88.00	-7	OF	Black
7	07.11.13	142	142	control	0	55.5	22	38	418	88.00	0	OF	Black
7	19.12.13	184	184	control	1	62	13	31	201.5	42.42	7	OF	Black
7	05.02.14	232	232	control	1	68	19	25	237.5	50.00	6	OF	Black
7	27.03.14	282	282	Control	0	62	19	31	294.5	62.00	-6	OF	Black
12	03.10.15	0	0	control	1	60	15	20	150	100.00	0	OH	mixed
12	21.11.15	49	49	control	1	65	15	25	187.5	125.00	-5	OH	mixed
12	09.01.16	98	98	control	1	70	17	30	255	170.00	-5	OH	mixed
12	27.02.16	147	147	control	1	63	20	37	370	246.67	-7	OH	mixed
14	19.05.16	0	0	control	1	60	20	35	350	100.00	0	NF	mixed
14	30.06.16	43	43	control	1	50	22	40	440	125.71	-5	NF	mixed
14	11.08.16	86	86	control	1	52	33	39	643.5	183.86	1	NF	mixed
14	21.09.16	127	127	control	1	56	35	35	612.5	175.00	4	NF	mixed
14	10.11.16	177	177	control	1	64	27	25	337.5	96.43	10	NF	mixed
15	19.05.16	0	0	control	1	70	20	24	240	100.00	0	of	mixed
15	30.06.16	43	43	control	1	60	12	30	180	75.00	-6	of	mixed
15	11.08.16	86	86	control	1	61	23	30	345	143.75	0	of	mixed
15	21.09.16	127	127	control	1	61	25	30	375	156.25	0	of	mixed
15	10.11.16	177	177	control	1	72	20	24	240	100.00	6	of	mixed
16	15.06.16	0	0	control	1	15	40	70	1400	100.00	0	OF	Black
16	21.07.16	36	36	control	0	22	30	60	900	64.29	10	OF	Black
16	01.09.16	78	78	control	1	30	30	57	855	61.07	3	OF	Black
16	12.10.16	119	119	control	1	35	28	45	630	45.00	12	OF	Black

Horse	Date	Days horse treated	Days treatment used	Treatment Group	Infection visible no = 0 Yes = 1	Hairline distance mm	Width mm	Height mm	Area Infected mm²	Area infected %	Height reduction mm	Near/ Off	Colour of foot
4	19.03.15	0	0	$CuSO_4$	1	69	19	34	323	100.00	0	OF	Black
4	12.05.15	54	54	$CuSO_4$	0	76	25	25	312.5	96.75	9	OF	Black
4	30.06.15	96	96	$CuSO_4$	0	79	22	16	176	54.49	9	OF	Black
4	18.08.15	145	145	$CuSO_4$	0	84	18	12	108	33.44	0	OF	Black
4	01.10.15	187	187	$CuSO_4$	0	90	12	6	36	11.15	6	OF	Black
4	19.11.15	236	236	$CuSO_4$	0	96	0	0	0	0.00	6	OF	Black
11	16.10.15	0	0	$CuSO_4$	1	40	50	50	1250	100.00	0	OH	Mixed
11	27.11.15	42	42	$CuSO_4$	0	55	45	42	945	75.60	8	OH	Mixed
11	16.01.16	92	92	$CuSO_4$	0	60	50	35	875	70.00	7	OH	Mixed
11	11.03.16	147	147	$CuSO_4$	0	70	40	28	560	44.80	7	OH	Mixed
11	06.05.16	203	203	$CuSO_4$	0	80	25	20	250	20.00	8	OH	Mixed
11	17.06.16	245	245	$CuSO_4$	0	85	18	10	90	7.20	10	OH	Mixed
11	30.07.16	288	288	$CuSO_4$	0	94	0	0	0	0.00	10	OH	Mixed
12C	26.08.16	322	0	$CuSO_4$	1	70	23	34	391	100.00	0	OH	mixed
12C	08.10.16	364	42	$CuSO_4$	0	75	25	28	350	89.51	6	OH	mixed
12C	11.11.16	399	77	$CuSO_4$	0	87	15	17	127.5	32.61	11	OH	mixed
5B	26.08.15	55	0	$CuSO_4$	1	57	70	23	805	100.00	0	OF	Black
5B	06.10.15	96	41	$CuSO_4$	0	70	65	17	552.5	68.63	6	OF	Black
5B	20.11.15	141	86	$CuSO_4$	0	75	60	7	210	26.09	10	OF	Black
5B	06.01.15	188	133	$CuSO_4$	0	85	0	0	0	0.00	7	OF	Black
5B	16.02.16	229	174	$CuSO_4$	0	85	0	0	0	0.00	0	OF	Black
6B	11.05.16	323	0	$CuSO_4$	1	60	20	35	350	100.00	0	NF	Black
6B	07.07.16	380	57	$CuSO_4$	0	68	22	27	297	84.86	8	NF	Black
6B	22.08.16	427	104	$CuSO_4$	0	67	29	24	348	99.43	3	NF	Black
7B	27.03.14	282	0	$CuSO_4$	0	62	19	31	294.5	100.00	0	OF	Black
7B	07.05.14	323	41	$CuSO_4$	0	65.5	19	28	266	90.32	3	OF	Black
7B	19.06.14	366	84	$CuSO_4$	0	75	16	19	152	51.61	9	OF	Black
7B	06.08.14	415	183	$CuSO_4$	0	85	25	9	112.5	38.20	10	OF	Black
7B	02.10.14	472	240	$CuSO_4$	0	93	0	0	0	0.00	9	OF	Black

Horse	Date	Days horse treated	Days treatment used	Treatment Group	Infection visible no = 0 Yes = 1	Hairline distance mm	Width mm	Height mm	Area Infected mm²	Area infected %	Height reduction mm	Near/ Off	Colour of foot
1	19.04.13	0	0	Iodine	1	59	28	31	434	100.00	0	NF	Mixed
1	14.06.13	63	63	Iodine	0	70	25	22	275	63.36	9	NF	Mixed
1	16.08.13	126	126	Iodine	0	78	19	13	123.5	28.46	9	NF	Mixed
1	18.10.13	189	189	Iodine	0	98	0	0	0	0.00	13	NF	Mixed
1	20.12.13	252	252	Iodine	0	100	0	0	0	0.00	0	NF	Mixed
2	19.04.13	0	0	Iodine	1	85.5	28	25	350	100.00	0	OF	Mixed
2	14.06.13	63	63	Iodine	0	100.5	28	9	126	36.00	16	OF	Mixed
2	16.08.13	126	126	Iodine	0	104	19	6	57	16.29	3	OF	Mixed
2	18.10.13	189	189	Iodine	0	100	0	0	0	0.00	6	OF	Mixed
3	18.06.13	0	0	Iodine	1	57	25	25	312.5	100.00	0	NF	Black
3	08.08.13	51	51	Iodine	1	64	28	19	266	85.12	6	NF	Black
3	26.09.13	100	100	Iodine	1	50	31	31	480.5	153.76	-12	NF	Black
3	7.11.13	142	142	Iodine	0	50	28	31	434	138.88	0	NF	Black
3	19.12.13	184	184	Iodine	0	56.5	25	25	312.5	100.00	6	NF	Black
3	05.02.14	232	232	Iodine	1	76	12	6	36	11.52	19	NF	Black
3	27.03.14	282	282	Iodine	0	83	0	0	0	0.00	6	NF	Black
3	07.05.14	323	323	Iodine	0	82.5	0	0	0	0.00	0	NF	Black
9	04.05.13	0	0	Iodine	1	84	12	16	96	100.00	0	OF	White
9	15.06.13	42	42	Iodine	1	84	16	16	128	133.33	0	OF	White
9	20.07.13	96	96	Iodine	0	88	16	12	96	100.00	4	OF	White
9	31.08.13	138	138	Iodine	1	84	20	16	160	166.67	-4	OF	White
9	05.10.13	168	168	Iodine	1	88	16	12	96	100.00	4	OF	White

Horse	Date	Days horse treated	Days treatment used	Treatment Group	Infection visible no = 0 Yes = 1	Hairline distance mm	Width mm	Height mm	Area Infected mm²	Area infected %	Height reduction mm	Near/ Off	Colour of foot
5	02.07.15	0	0	SD115	1	59	70	25	875	100.00	0	OF	Black
5	29.07.15	27	27	SD115	1	60	70	25	875	100.00	0	OF	Black
5	26.08.15	55	55	SD115	1	57	70	23	805	92.00	2	OF	Black
6	23.06.15	0	0	SD115	1	68	16	22	176	100.00	0	NF	Black
6	18.08.15	56	56	SD115	1	65	20	25	250	142.05	-3	NF	Black
6	01.10.15	100	100	SD115	1	65	25	26	325	184.66	-1	NF	Black
6	19.11.15	149	149	SD115	0	73	30	28	420	238.64	-2	NF	Black
6	20.01.16	211	211	SD115	1	74	30	27	405	230.11	1	NF	Black
6	16.03.16	267	267	SD115	1	78	22	17	187	106.25	10	NF	Black
6	11.05.16	323	323	SD115	1	60	20	35	350	198.86	-18	NF	Black
8	01.10.15	0	0	SD115	1	70	22	20	220	100.00	0	Nf	Black
8	19.11.15	49	49	SD115	0	73	27	22	297	135.00	-2	Nf	Black
8	06.01.16	97	97	SD115	0	77	21	21	220.5	100.23	1	Nf	Black
8	02.03.16	152	152	SD115	1	78	18	17	153	69.55	4	Nf	Black
8	14.04.16	201	201	SD115	1	82	18	15	135	61.36	2	Nf	Black
8	24.05.16	241	241	SD115	0	84	10	8	40	18.18	7	Nf	Black
8	14.07.16	285	285	SD115	0	93	0	0	0	0.00	8	Nf	Black
12B	27.02.16	147	0	SD115	1	63	20	37	370	100.00	0	OH	mixed
12B	09.04.16	189	42	SD115	1	60	20	40	400	108.11	-3	OH	mixed
12B	21.05.16	231	84	SD115	1	62	20	32	320	86.49	8	OH	mixed
12B	09.07.16	273	126	SD115	1	60	20	30	300	81.08	2	OH	mixed
12B	26.08.16	322	175	SD115	1	70	23	34	391	105.68	-4	OH	mixed

Hairline growth rate (mm/day), one-way analysis of variance

		Control	CuSO4	Iodine	SD115	all groups	
		0.025	0.114	0.206	-0.036		
		0.020	0.188	0.077	-0.025		
		0.023	0.221	0.092	0.081		
		0.011	0.211	0.024	0.040		
		0.168	0.067				
			0.129				
Sum y (sum of observed values)	T_i	0.247	0.930	0.399	0.060	1.636	= T
number of values in each group	n_i	5.000	6.000	4.000	4.000	19.000	=N
mean of values in each group	$\bar{y}_i$	0.049	0.155	0.100	0.015		
sum of values squared in each group	S_i	0.030	0.163	0.058	0.010	0.260	=S
	T_i^2/n_i	0.012	0.144	0.040	0.001		

Between groups SSq (sum of squares)	=	0.056	= (sum of T_i^2/n_i) - T^2/N
Total SSq	=	0.119	= S - T^2/N
Within Groups SSq	=	0.063	=Total SSq - Between groups SSq

Analysis of Variance

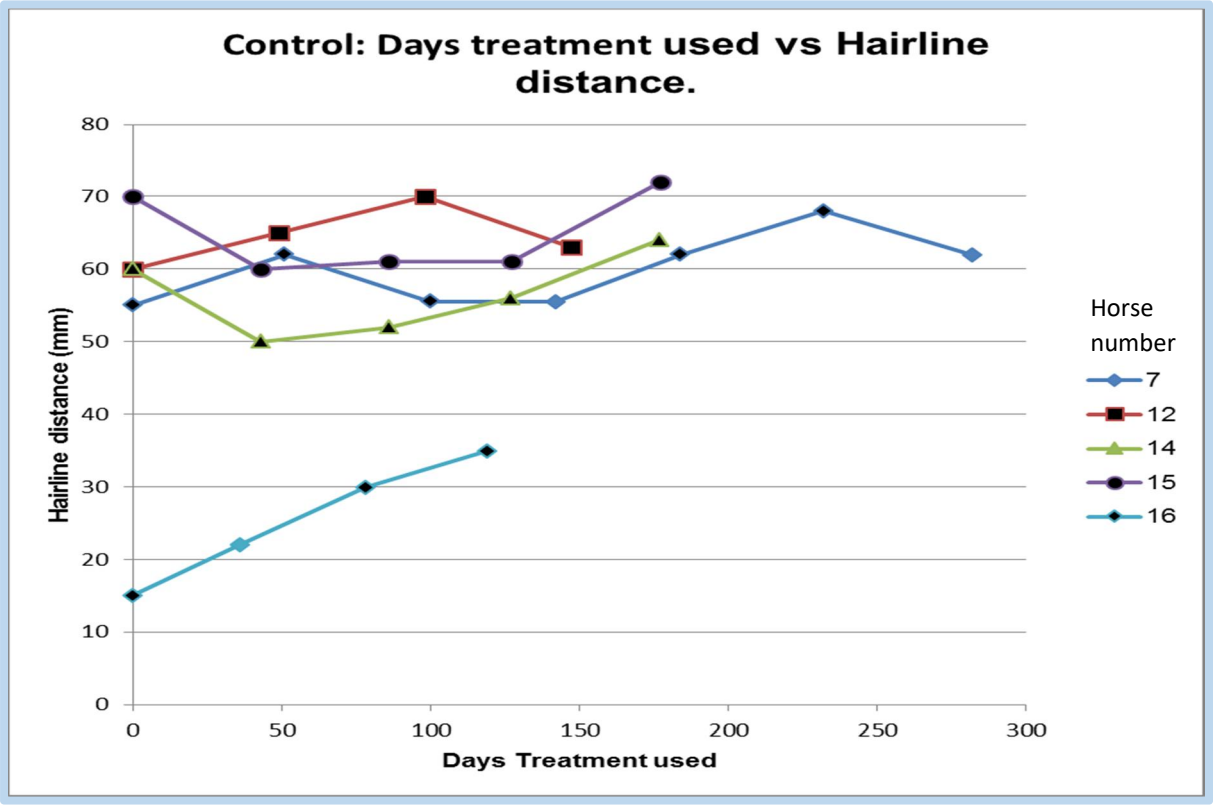
	SSq	DF	MSq	**VR (F)**
Between groups	0.056	3.000	0.019	4.456
Within groups	0.063	15.000	0.004	

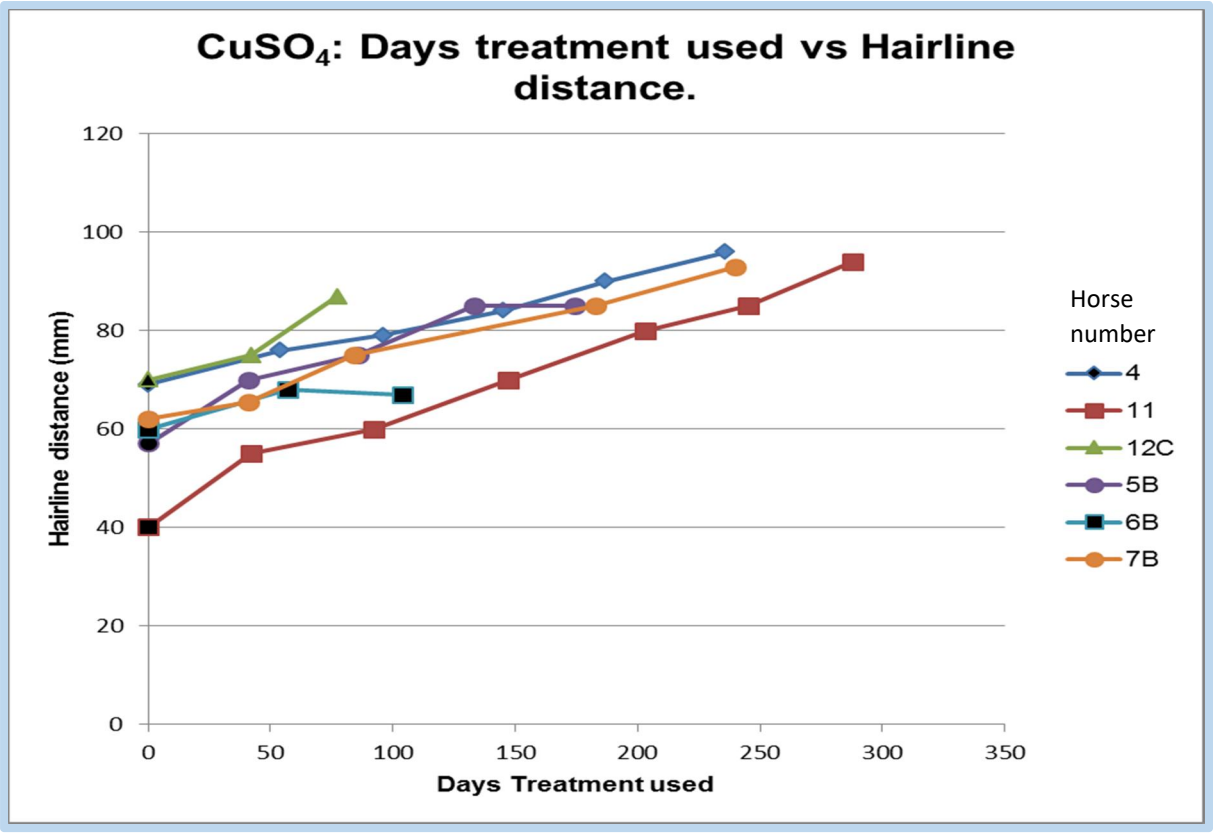
DF for between groups = k-1 (no of groups - 1)
DF for within groups = N-k (total number of values - number of groups)
MSq = SSq/DF
VR (Variance ratio or F) = MSq between/MSq within

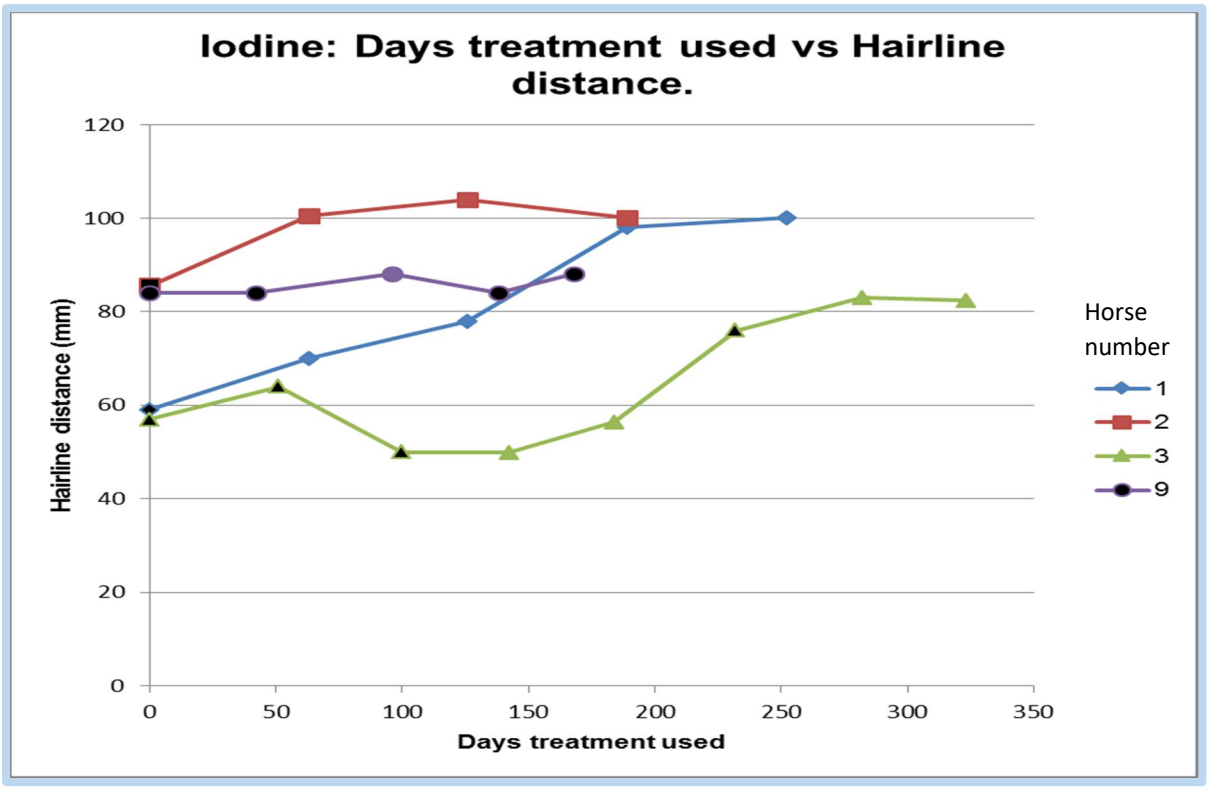
For v1 =3 (numerator) and v2 = 15 (denominator) the F value is significant (P<0.05), i.e. there is a difference between the four groups.

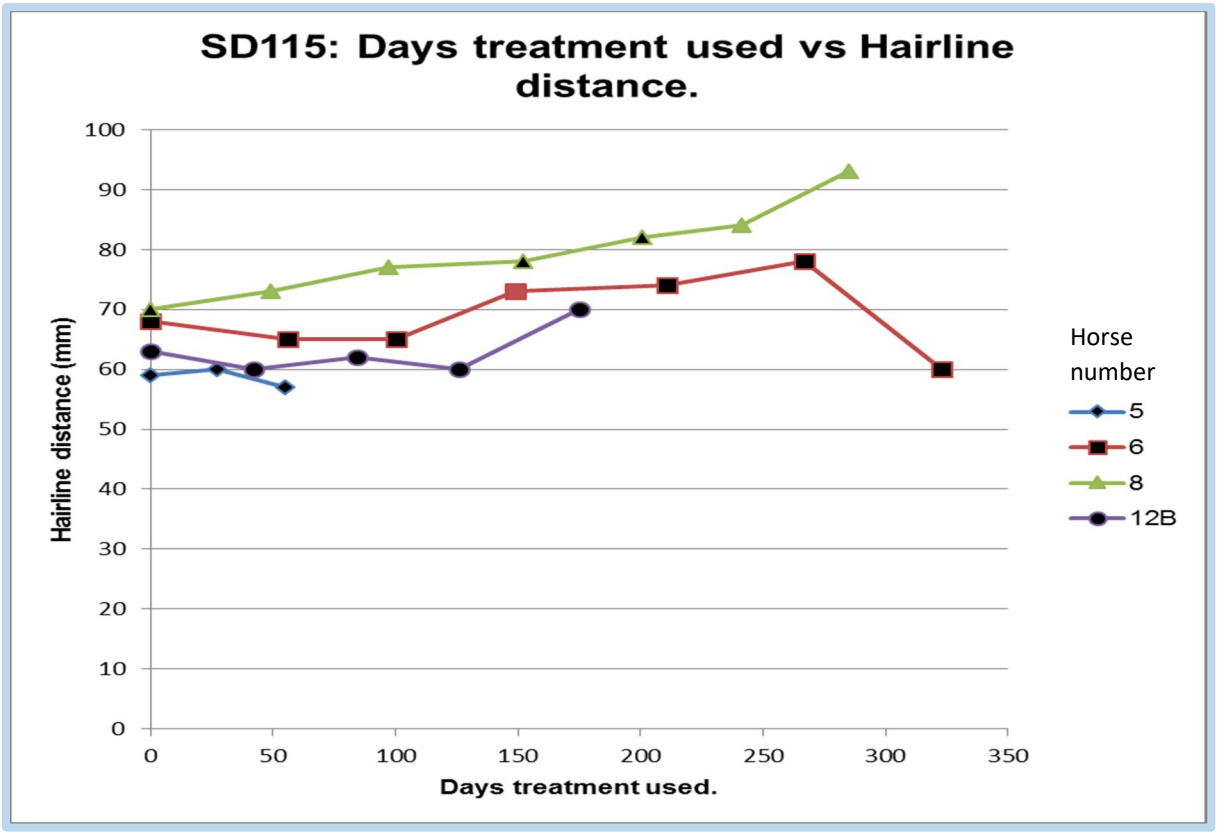
Appendix F

Data lines for each horse, black data points show presence of visible infection.

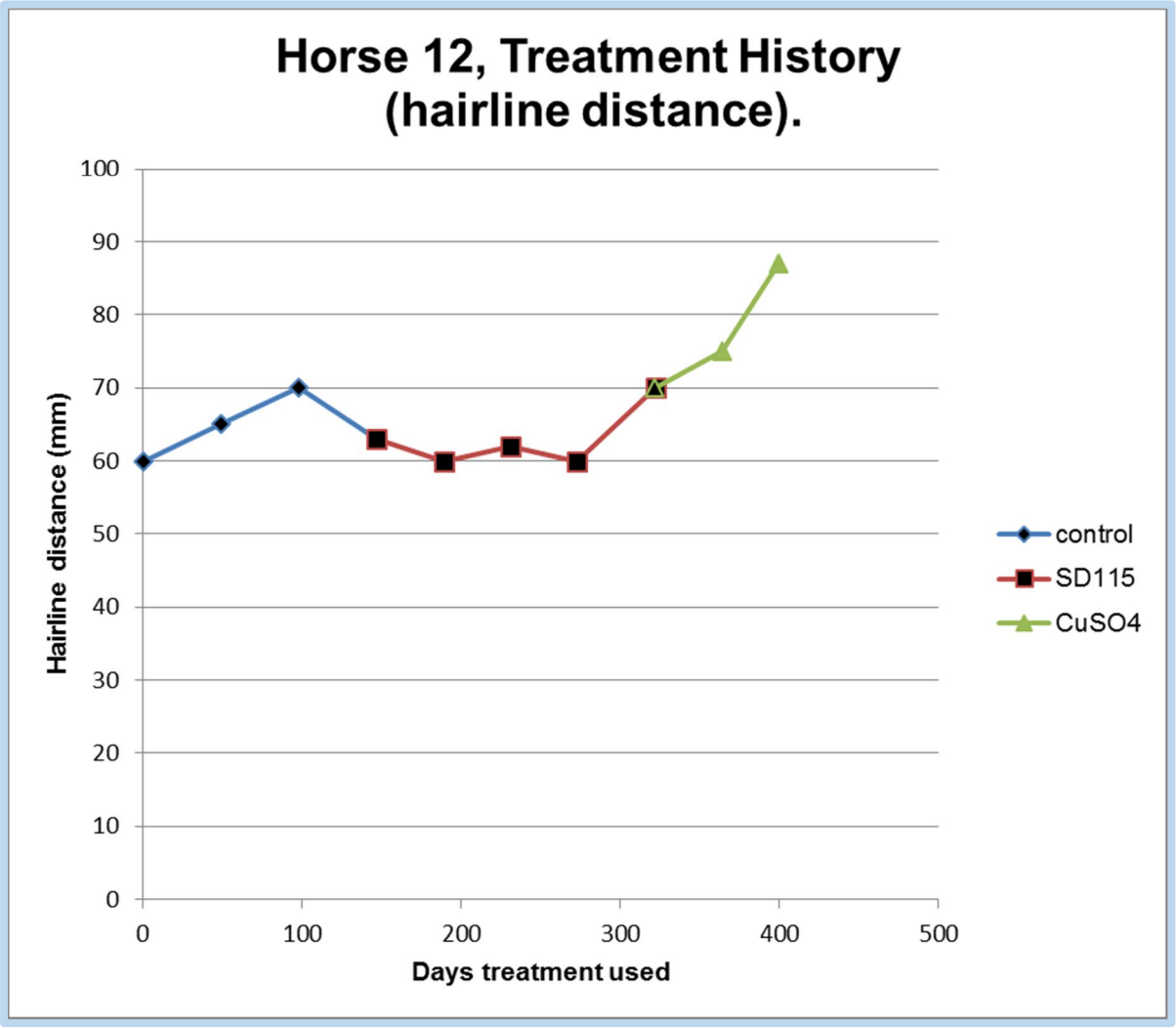





Iodine: Days treatment used vs Hairline distance.
Hairline distance (mm)
120
100
80
60
40
20
0
0
50
100
150
200
250
300
350
Days treatment used
Horse number
1
2
3
9


SD115: Days treatment used vs Hairline distance.
Hairline distance (mm)
100
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
Days treatment used.
Horse number
5
6
8
12B

Appendix G


Horse 12, Treatment History (hairline distance).
Hairline distance (mm)
100
90
80
70
60
50
40
30
20
10
0
0
100
200
300
400
500
Days treatment used
control
SD115
CuSO4

Appendix H

Permissions

29.11.16

Hi Sarah

This email is to confirm that I give my permission; as copyright owner of Corrective Farriery, a textbook of remedial horseshoeing, volumes I and II, for you to use any illustration providing that you give the appropriate acknowledgements beneath the artwork used.

Simon Curtis

Appendix I

Battles

Version 1
December 2014

SAFETY DATA SHEET

According to Regulation EC No. 1907/2006

Section 1. Identification of the substance/mixture and of the company/undertaking

1.1 Product Identifier Copper Sulphate

Other Identifier

1.2. Relevant identified uses of the substance or mixture and uses advised against

Product Use For use in a cattle footbath

1.3. Details of the supplier of the safety data sheet

Company Battle, Hayward & Bower Ltd.,
Crofton Drive,
Lincoln.
LN3 4NP

Telephone 01522 541241

Email address phillip@battles.co.uk

1.4. Emergency telephone number

Telephone 01522 541241

Section 2. Hazards identification

2.1

Classification under Regulation (EC) No. 1272/2008

Cat 4 Acute Toxicity
Cat 2 Skin Irrit
Cat 2 Eye Irrit
Cat 1 Acute Aquatic
Cat 1 Chronic Aquatic

2.2 Label elements

Classification under Regulation (EC) No. 1272/2008

Pictogram

Signal word	Warning
Hazards statements	Harmful if swallowed Causes skin irritation Causes serious eye irritation Very toxic to aquatic life with ong lasting effects
Precautionary statements	Avoid release to the environment Wear protective gloves and eye protection IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. IF ON SKIN: Wash with plenty of soap and water IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses. If present and easy to do. Continue rinsing. Keep out of the reach of children. Do not eat drink or smoke when using this product.

Page 1 of 5

If skin irritation occurs: Get medical advice.
If eye irritation persists: Get medical advice.
Dispose of contents in accordance with regional regulations.

2.3 Other hazards

Section 3: Composition / Information on ingredients

3.1 Substances
3.2 Mixtures

Chemical name	Registration number(s)	Classification Regulation (EC) No. 1272/2008	Concentration
Copper Sulphate Pentahydrate	7758-99-8 029-004-00-0 231-847-6	Cat 4 Acute Toxicity Cat 2 Skin Irrit Cat 2 Eye Irrit Cat 1 Acute Aquatic Cat 1 Chronic Aquatic	90-100%

Section 4: First Aid Measures

4.1 Description of first aid measures

General advice	Remove all contaminated clothing immediately. Provide rest, warmth and fresh air. Seek medical advice.
If in eyes	Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do and continue rinsing
If inhaled	Remove victim to fresh air and keep at rest in a position comfortable for breathing.
In case of skin contact	Remove contaminated clothing. Wash with soap and water.
If swallowed	Do NOT induce vomiting Never give anything by mouth to an unconscious person Obtain medical attention

4.2. Most important symptoms and effects, both acute and delayed

Irritation to nose, throat and airways. Metallic taste.
Nausea, vomiting, diarrhoea, headache, sweating, yellowing of skin,
Over exposure, if severe enough, may be fatal.
Skin irritation, mild dermatitis.
Severe eye irritation. Burns can occur.

4.3. Indication of any immediate medical attention and special treatment needed

Unless extensive vomiting has occurred, empty stomach by gastric lavage. Probable mucosal damage may contraindicate use of gastric lavage.

Section 5: Firefighting Measures

5.1 Extinguishing media

Suitable extinguishing media	Water, foam, powder or carbon dioxide.

Unsuitable extinguishing media

5.2. Special hazards arising from the substance or mixture

When heated and in case of fire, toxic vapours/gases may be formed.

5.3. Advice for fire fighters

In the event of a fire, wear self-contained breathing apparatus

Keep run off water out of sewers and water sources.

Section 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use personal protective equipment

Avoid breathing dust

Avoid contact with skin and eyes.

6.2. Environmental precautions

Prevent product from entering drains, watercourses.

6.3. Methods and material for containment and cleaning up

Contain spillage and dispose of in accordance with local regulations.

6.4. Reference to other sections

Section 7: Handling and storage

7.1. Precautions for safe handling

Keep container tightly closed

Wash hands after handling

Wear protective eye protection

Avoid breathing dust

Avoid skin and eye contact

7.2. Conditions for safe storage, including any incompatibilities

Keep container tightly closed

Store locked up

7.3. Specific end use(s)

Section 8: Exposure controls / personal protection

8.1. Control parameters

Components with workplace control parameters

Component	Cas – No.	Value	Control parameters	Basis
Copper Sulphate	7758-99-8	TWA STEL	0.041mg/kg/day oral 0.082mg/kg/day oral	UK EH40 WEL

8.2. Exposure controls

Keep container tightly closed

Wash hands thoroughly after handling

Wear protective eye protection.

Avoid breathing dust

Avoid skin and eye contact

Section 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Blue crystalline powder
Odour	Odourless
pH	No data available
Melting point / freezing point	No data available
Initial boiling point and boiling range	No data available
Flash point	No data available
Evaporation rate	No data available
Flammability (solid, gas)	No data available
Upper / lower flammability or explosive limits	No data available
Vapour pressure	No data available
Vapour density	No data available
Relative density	No data available
Solubility(ies)	Soluble in water
Partition coefficient: n-octanol / water	No data available
Auto ignition temperature	No data available
Decomposition temperature	110°C
Viscosity	No data available
Explosive properties	No data available
Oxidising properties	No data available

9.2. Other information

Section 10: Stability and reactivity

10.1. Reactivity

Violent reaction with hydrogen peroxide, bromates, chlorates

10.2. Chemical stability

Stable under normal temperature conditions and recommended use

10.3. Possibility of hazardous reactions

The material is acidic when dissolved in water and can react with magnesium to form hydrogen gas.

10.4. Conditions to avoid

Heat

10.5. Incompatible materials

Avoid contact with strong acids, hydrogen peroxide or oxidising agents

10.6. Hazardous decomposition products

Sulphurous gases (SOx), Cupric Oxide

Section 11: Toxicological information

Acute toxicity > 480mg/kg Rat oral

Section 12: Ecological information

12.1 Toxicity

Very toxic to aquatic organisms, may cause long term effects ijn the aquatic environment.

12.2 Persistence and degradability

The copper ions resulting from the degradation of this product cannot be degraded. Copper does not meet the criteria as 'persistent'

12.3. Bioaccumulative potential
The bioaccumulative criteria are not applicable to essential metals
12.4. Mobility in soil
Copper ions bind strongly to soil.
12.5. Results of PBT and vPvB assessment
Not classified under current EU criteria
12.6. Other adverse effects

Section 13: Disposal considerations

Dispose of waste and residues in accordance with local authority requirements

Section 14: Transport information

14.1. UN number	3077
14.2. UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, NOS
14.3. Transport hazard class(es)	9
14.4. Packing group	III
14.5. Environmental hazards	Environmentally hazardous substance/Marine pollutant
14.6. Special precautions for user	EAC 2Z
14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	

Section 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
This safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006
15.2. Chemical safety assessment

No data available

Section 16: Other information

Appendix J

REVISION DATE: 28.05.2014

POYNTON LTD

SAFETY DATA SHEET
IMPRINT HOOF REPAIR
PRODUCT CODE: IG500

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING
PRODUCT NAME: IMPRINT HOOF REPAIR
SUPPLIER: POYNTON LTD
TOWN FORGE HIGH STREET
MALMESBURY
WILTSHIRE
SN16 9AT

EMERGENCY TELEPHONE NUMBER: +44 (0) 1666 822953 FAX NUMBER: +44 (0) 1666 822953

2. HAZARDS IDENTIFICATION
Substance not classified according to the latest editions of the EU lists

3. COMPOSITION/INFORMATION ON INGREDIENTS
Identification number(s)
EINECS Number: Polymer
Chemical components:

CAS: 24980-41-4	2-Oxepanone, homopolymer	≥99%
Additional information: For the wording of the listed risk phrases refer to section 16		

4 FIRST AID MEASURES
After inhalation: Supply fresh air; consult doctor in case of complaints.
After skin contact:
Wash with water and soap and rinse thoroughly.
After contact with the molten product, cool rapidly with cold water.
After eye contact: Rinse opened eye under running water.
After swallowing: If you feel unwell consult a doctor.

5 FIRE FIGHTING MEASURES
Suitable extinguishing agents:
Water Spray
Foam
Carbon dioxide
Fire-extinguishing powder
Special hazards caused by the substance, its products of combustion or resulting gases:
In case of fire, the following can be released:
Carbon monoxide (CO)
Monomer (2-Oxepanone, Hexan-6-Olide, CAS 502-44-3)
Protective equipment: Wear self-contained respiratory protective device.

6 ACCICDENTAL RELEASE MEASURES
Person-related safety precautions: Wear protective equipment. Keep unprotected persons away.
Measures for environmental protection:
Do not allow product to reach sewage system or any water course.
Measures for cleaning/collecting: Pick up mechanically

7 HANDLING AND STORAGE
Information for safe handling:
Prevent formation of dust.
Ensure good ventilation/exhaustion at the workplace.
If handling molten product, be aware of risk for burns
Storage:
Requirements to be met by storerooms and receptacles: Store only in the original receptacle.
Further information about storage conditions:
Use grounded equipment
Prevent electrostatic discharges
Store in cool, dry conditions in well sealed receptacles.

IMPRINT CUSTOMER SERVICES
POYNTON LTD, TOWN FORGE, HIGH STREET,
MALMESBURY, WILTSHIRE, SN16 9AT, UK.
TEL: +44 (0) 1666 822953 FAX: +44 (0) 1666 822953

IMPRINT®
EQUINE FOOT CARE

8 EXPOSURE CONTROLS/PERSONAL PROTECTION
Ingredients with limit values that require monitoring at the workplace:
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
Additional information: The lists valid during the making were used as basis.
Personal protection equipment:
Respiratory protection:
Use suitable respiratory protective device in case of insufficient ventilation.
Filter P1
Protection of hands:

Protective gloves

Material of gloves
PVC gloves
Chloroprene rubber CR
Butyl rubber, BR
Penetration time of glove material
The exact break trough time has to be found out by the manufacturer of the protective gloves and has to be observed
Eye protection:

Safety glasses

9 PHYSICAL AND CHEMICAL PROPERTIES
General Information

Form:	Granulate
Colour:	White
Odour:	Odourless

Change in condition

Melting point/Melting range:	58-60°C
Boiling point/Boiling range:	Undetermined
Flash point:	275°C
Ignition temperature:	
Decomposition temperature:	200°C
Self-igniting:	Product is not self igniting
Danger of explosion:	Product does not present an explosion hazard.
Density at 60°C	1.1 g/cm³
Solubility in/Miscibility with water	Insoluble

Partition coefficient (n-octanol/water): Undetermined.
Viscosity: Dynamic at 100°C 1500000 mPas

10 STABILITY AND REACTIVITY
Thermal decomposition/conditions to be avoided:
To avoid thermal decomposition do not overheat.
Materials to be avoided:
Avoid contact with acids.
Avoid contact with bases.
Dangerous reactions: Possible build up of electrical discharges, which could cause a fire.

POYNTON LTD

SAFETY DATA SHEET
IMPRINT HOOF REPAIR
PRODUCT CODE: IG500

11 TOXICOLOGICAL INFORMATION
Acute toxicity:
LD/LC50 values relevant for classification:
37625-56-2 2-Oxepanone, polymer with 2-ethyl-2-(hydroxymethyl)-1,3 propanediol
Oral LD50 >2000 mg/kg (rat)
Primary irritant effect:
On the skin: No irritating effect
On the eye: No irritating effect
Other information (about experimental toxicology):
The studies regarding LD50 oral and irritation tests on eye and skin are made on a similar product.
Additional toxicological information:
The product is not subject to classification according to the calculation method of the General EU Classification Guidelines for preparations as issued in the latest version.
When used and handled according to specifications, the product doese not have any harmful effects to our experience and the information provided to us.

12 ECOLOGICAL INFORMATION
Information about elimination (persistence and degradability):
37625-56-2 2 Oxepanone, polymer with 2-ethyl-2 (hydroxymethyl)-1,3-propanediol
Biotic degradation >60% (STURM)
Other information: The product is readily biodegradable.
Ecotoxicological effects:
Aquatic toxicity:
37625-56-2 2-Oxepanone, polymer with 2-ethyl-2-(hydroxymethyl)-1,3-propanediol
IC50 670mg/1 (bacteria)
IC50/96 h 150mg/1 (fish)
Remark: The product is not classified as dangerous to the environment
Other information: the studies regarding aquactic toxicity are made on a similar product.

13 DISPOSAL CONSIDERATIONS
European waste catalogue
07 00 00 WASTES FROM ORGANIC CHEMICAL PROCESSES
07 02 00 wastes from the MFSU of plastaics, synthetic rubber and man-made fibre
07 02 13 waste plastic
Recommendation: Disposal must be made according to official regulations.

14 TRANSPORT INFORMATION
Land transport ADR/RID (cross-border)
ADR/RID class: –
Maritime transport IMDG:
IMDG Class: -
Air transport ICAO-TI and IATA-DGR:
ICAO/IATA Class: -
Transport/Additional information: Not dangerous goods according to the above specifications.

15 REGULATORY INFORMATION
Labelling according to EU guidelines:
Observe the general safety regulations when handling chemicals.
The product is not subject to identification regulations under EU Directives and the Ordinance on Hazardous Materials

16 OTHER INFORMATION
This Safety Data Sheet is not a Product Specification. It is based on our present knowledge and experience and it is intended to serve as a guide for safe handling of the product regarding to health and environmental aspects.

DISCLAIMER

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

IMPRINT CUSTOMER SERVICES
POYNTON LTD, TOWN FORGE, HIGH STREET,
MALMESBURY, WILTSHIRE, SN16 9AT, UK.
TEL: +44 (0) 1666 822953 FAX: +44 (0) 1666 822953

IMPRINT®
EQUINE FOOT CARE

Appendix K

Revision Date 27/06/12
Revision 4
Supersedes date 02/12/11

SAFETY DATA SHEET
IMPRINT SHOE FREEZER

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product identifier

Product name IMPRINT SHOE FREEZER
Internal Id ISF200

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.3. Details of the supplier of the safety data sheet

Supplier POYNTON LTD.
TOWN FORGE, HIGH STREET, MALMESBURY, WILTSHIRE, SN16 9AT UK
+44 (0) 1666 822953
sales@imprintshoes.co.uk

1.4. Emergency telephone number

+44 (0) 1666 822953

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

Classification (EC 1272/2008)

Physical and Chemical Hazards	Not classified.
Human health	Not classified.
Environment	Not classified.

Classification (67/548/EEC) Not classified.

The Full Text for all R-Phrases and Hazard Statements are Displayed in Section 16.

2.2. Label elements

Label In Accordance With (EC) No. 1272/2008

No pictogram required.

Precautionary Statements

P102	Keep out of reach of children.
P210	Keep away from open flames. - No smoking.
P251	Pressurized container: Do not pierce or burn, even after use.
P271	Use only outdoors or in a well-ventilated area.
P410+412	Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122° F.

Supplementary Precautionary Statements

P501	Dispose of contents/container in accordance with local regulations.

Supplemental label information

EUH210	Safety data sheet available on request.

2.3. Other hazards

This product does not contain any PBT or vPvB substances.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substances

1,1,1,2-TETRAFLUOROETHANE **CAS-No.: 811-97-2**	**EC No.: 212-377-0**	**60-100%** **Registration Number: 01-2119459374-33-xxxx**
Classification (EC 1272/2008) Press. Gas, Compressed - H280		Classification (67/548/EEC) Not classified.

The Full Text for all R-Phrases and Hazard Statements are Displayed in Section 16.

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures

Inhalation

Move into fresh air and keep at rest. Get medical attention if any discomfort continues.

Ingestion

Provide rest, warmth and fresh air. Immediately rinse mouth and drink plenty of water (200-300 ml). Get medical attention if any discomfort continues.

Skin contact

Rinse immediately with plenty of water. Get medical attention promptly if symptoms occur after washing.

Eye contact

Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyes wide apart. Rinse with water. Contact physician if discomfort continues.

4.2. Most important symptoms and effects, both acute and delayed

Inhalation.

Vapours may cause drowsiness and dizziness.

Ingestion

Due to the physical nature of this material it is unlikely that swallowing will occur.

Eye contact

Irritation of eyes and mucous membranes.

4.3. Indication of any immediate medical attention and special treatment needed

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing media

Extinguishing media

The product is non-combustible. Use fire-extinguishing media appropriate for surrounding materials.

5.2. Special hazards arising from the substance or mixture

Unusual Fire & Explosion Hazards

Aerosol cans may explode in a fire.

5.3. Advice for firefighters

Special Fire Fighting Procedures

Cool containers exposed to flames with water until well after the fire is out.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Avoid inhalation of vapours and aerosol spray. Avoid contact with skin and eyes.

6.2. Environmental precautions

Not relevant considering the small amounts used.

6.3. Methods and material for containment and cleaning up

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Ventilate. Ventilate well.

6.4. Reference to other sections

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for safe handling

Avoid contact with skin and eyes. Keep away from heat, sparks and open flame.

7.2. Conditions for safe storage, including any incompatibilities

Aerosol cans: Must not be exposed to direct sunlight or temperatures above 50°C.

7.3. Specific end use(s)

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

Name	STD	TWA - 8 Hrs		STEL - 15 Min		Notes
1,1,1,2-TETRAFLUOROETHANE	WEL	1000 ppm	4240 mg/m3			

WEL = Workplace Exposure Limit.

8.2. Exposure controls

Protective equipment


Hand protection

For prolonged or repeated skin contact use suitable protective gloves. Use protective gloves made of: Rubber, neoprene or PVC.

Eye protection

Wear approved chemical safety goggles where eye exposure is reasonably probable.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

Appearance	Aerosol.
Colour	Colourless.
Odour	Mild.

9.2. Other information

No information required.

SECTION 10: STABILITY AND REACTIVITY

10.1. Reactivity

No specific reactivity hazards associated with this product.

10.2. Chemical stability

Stable under normal temperature conditions and recommended use.

10.3. Possibility of hazardous reactions

Not determined.

10.4. Conditions to avoid

Avoid heat, flames and other sources of ignition.

10.5. Incompatible materials

Materials To Avoid

No incompatible groups noted.

10.6. Hazardous decomposition products

Fire or high temperatures create: Fluorides.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Inhalation

Vapours may cause drowsiness and dizziness.

Ingestion

No harmful effects expected in amounts likely to be ingested by accident.

Skin contact

Liquid on the skin could result in freeze burns.

Eye contact
Irritation of eyes and mucous membranes.
Toxicological information on ingredients.
1,1,1,2-TETRAFLUOROETHANE (CAS: 811-97-2)

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity
Not regarded as dangerous for the environment.

12.1. Toxicity
Acute Toxicity - Fish
Not applicable.

12.2. Persistence and degradability
Degradability
There are no data on the degradability of this product.

12.3. Bioaccumulative potential
Bioaccumulative potential
No data available on bioaccumulation.

12.4. Mobility in soil
Mobility:
The product contains volatile organic compounds (VOC) which will evaporate easily from all surfaces.

12.5. Results of PBT and vPvB assessment

12.6. Other adverse effects
Not determined.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods
Dispose of waste and residues in accordance with local authority requirements.

SECTION 14: TRANSPORT INFORMATION

14.1. UN number
UN No. (ADR/RID/ADN)	1950
UN No. (IMDG)	1950
UN No. (ICAO)	1950

14.2. UN proper shipping name
Proper Shipping Name	AEROSOLS

14.3. Transport hazard class(es)
ADR/RID/ADN Class	Class 2: Gases
IMDG Class	2
ICAO Class/Division	2

14.4. Packing group
ADR/RID/ADN Packing group	5A

14.5. Environmental hazards
Environmentally Hazardous Substance/Marine Pollutant
No.

14.6. Special precautions for user
Tunnel Restriction Code	**(E)**

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
Not applicable.

SECTION 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Statutory Instruments

Control of Substances Hazardous to Health.

Guidance Notes

Workplace Exposure Limits EH40.

EU Legislation

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 with amendments.

15.2. Chemical Safety Assessment

SECTION 16: OTHER INFORMATION

Revision Date	27/06/12
Revision	4
Supersedes date	02/12/11
Date	21/11/11
Risk Phrases In Full	
NC	Not classified.
Hazard Statements In Full	
H280	Contains gas under pressure; may explode if heated.

IMPRINT CUSTOMER SERVICES
POYNTON LTD. TOWN FORGE, HIGH STREET,
MALMESBURY, WILTSHIRE, SN16 9AT, UK.
TEL: +44 (0) 1666 822953
FAX: +44 (0) 1666 822953

IMPRINT®
EQUINE FOOT CARE

Appendix L

SAFETY DATA SHEET
IMPRINT STRUCTURAL ADHESIVE
ADHESIVE AND ACTIVATOR

ADHESIVE

Revision date: 11/06/2015 Revision: 9 Supersedes date: 24/11/2014

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name IMPRINT STRUCTURAL ADHESIVE (ADHESIVE)

REACH registration notes CAS 80-62-6: 01-2119452498-28-XXXX CAS 79-41-4: 01-2119463884-26-XXXX

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses Adhesive

1.3. Details of the supplier of the safety data sheet

Supplier Poynton Ltd
Town Forge
High Street
Malmesbury
Wiltshire
SN16 9AT
+44 (0) 1666 822953
sales@imprintshoes.co.uk

1.4. Emergency telephone number

Emergency telephone +44 (0) 1666 822953

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture Classification

Classification

Physical hazards Flam. Liq. 2 - H225

Health hazards Skin Irrit. 2 - H315 Skin Sens. 1 - H317 STOT SE 3 - H335

Environmental hazards Not Classified

Classification (67/548/EEC or 1999/45/EC) Xi;R36/37/38. R43. F;R11.

2.2. Label elements

Pictogram

Signal word Danger

Hazard statements H225 Highly flammable liquid and vapour.
H315 Causes skin irritation.
H317 May cause an allergic skin reaction.
H335 May cause respiratory irritation.

Precautionary statements	P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. P261 Avoid breathing vapour/spray. P280 Wear protective gloves/protective clothing/eye protection/face protection. P303+P361+P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. P332+P313 If skin irritation occurs: Get medical advice/attention. P501 Dispose of contents/container in accordance with national regulations.
Contains	METHYL METHACRYLATE, METHACRYLIC ACID
Supplementary precautionary statements	P240 Ground/bond container and receiving equipment. P241 Use explosion-proof electrical equipment. P242 Use only non-sparking tools. P243 Take precautionary measures against static discharge. P264 Wash contaminated skin thoroughly after handling. P271 Use only outdoors or in a well-ventilated area. P272 Contaminated work clothing should not be allowed out of the workplace. P302+P352 IF ON SKIN: Wash with plenty of water. P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing. P312 Call a POISON CENTRE/doctor if you feel unwell. P321 Specific treatment (see medical advice on this label). P333+P313 If skin irritation or rash occurs: Get medical advice/attention. P362+P364 Take off contaminated clothing and wash it before reuse. P370+P378 In case of fire: Use foam, carbon dioxide, dry powder or water fog to extinguish. P403+P233 Store in a well-ventilated place. Keep container tightly closed. P403+P235 Store in a well-ventilated place. Keep cool. P405 Store locked up.

2.3. Other hazards

This product does not contain any substances classified as PBT or vPvB.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

METHYL METHACRYLATE CAS number: 80-62-6	EC number: 201-297-1	**30-60%** REACH registration number: 01-2119452498-28-0000

Classification Flam. Liq. 2 - H225 Skin Irrit. 2 - H315 Skin Sens. 1 - H317 STOT SE 3 - H335	**Classification** (67/548/EEC or 1999/45/EC) F;R11 R43 Xi;R37/38

METHACRYLIC ACID CAS number: 79-41-4	EC number: 201-204-4	**5-10%** REACH registration number: 01-2119463884-26-0000

Classification Acute Tox. 4 - H302 Acute Tox. 4 - H312 Skin Corr. 1A - H314 Eye Dam. 1 - H318 STOT SE 3 - H335	**Classification (67/548/EEC or 1999/45/EC)** C;R35 Xn;R21/22

The Full Text for all R-Phrases and Hazard Statements are Displayed in Section 16.

SECTION 4: First aid measures

4.1. Description of first aid measures

General information Avoid contact with skin and eyes. Do not breathe vapour/spray. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

Inhalation Move affected person to fresh air at once. When breathing is difficult, properly trained personnel may assist affected person by administering oxygen. Get medical attention if any discomfort continues.

Ingestion Do not induce vomiting. Give plenty of water to drink. Get medical attention.

Skin contact Remove affected person from source of contamination. Wash skin thoroughly with soap and water. Get medical attention if irritation persists after washing.

Eye contact Remove any contact lenses and open eyelids wide apart. Continue to rinse for at least 15 minutes and get medical attention. Get medical attention if irritation persists after washing.

4.2. Most important symptoms and effects, both acute and delayed

General information The severity of the symptoms described will vary dependent on the concentration and the length of exposure.

4.3. Indication of any immediate medical attention and special treatment needed

Notes for the doctor No specific recommendations. If in doubt, get medical attention promptly.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media Extinguish with foam, carbon dioxide or dry powder.

5.2. Special hazards arising from the substance or mixture

Specific hazards Highly flammable. Avoid breathing fire gases or vapours. Vapours are heavier than air and may spread near ground and travel a considerable distance to a source of ignition and flash back. Polymerises easily with evolution of heat.

5.3. Advice for firefighters

Protective actions during firefighting Keep up-wind to avoid fumes. Do not use water jet as an extinguisher, as this will spread the fire. Cool containers exposed to flames with water until well after the fire is out. Control run-off water by containing and keeping it out of sewers and atercourses.

Special protective equipment for firefighters Wear positive-pressure self-contained breathing apparatus (SCBA) and appropriate protective clothing.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions Highly flammable Warn everybody of potential hazards and evacuate if necessary. No smoking, sparks, flames or other sources of ignition near spillage. Provide adequate ventilation. Avoid contact with skin and eyes. Avoid inhalation of spray mist and contact with skin and eyes. Wear protective clothing as described in Section 8 of this safety data sheet.

6.2. Environmental precautions

Environmental precautions Avoid the spillage or runoff entering drains, sewers or watercourses. Spillages or uncontrolled discharges into watercourses must be reported immediately to the Environmental Agency or other appropriate regulatory body.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up Absorb spillage with non-combustible, absorbent material. Collect and place in suitable waste disposal containers and seal securely. Containers with collected spillage must be properly labelled with correct contents and hazard symbol.

6.4. Reference to other sections

Reference to other sections For personal protection, see Section 8. For waste disposal, see section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Usage precautions Provide adequate general and local exhaust ventilation. Observe any occupational exposure limits for the product or ingredients. Avoid contact with skin and eyes. Take precautionary measures against static discharges. Storage tanks and other containers must be earthed. No smoking, sparks, flames or other sources of ignition near spillage. Good personal hygiene procedures should be implemented.

7.2. Conditions for safe storage, including any incompatibilities

Storage precautions Store in tightly-closed, original container in a dry, cool and well-ventilated place.

7.3. Specific end use(s)

Specific end use(s) The identified uses for this product are detailed in Section 1.2.

SECTION 8: Exposure Controls/personal protection

8.1. Control parameters

Occupational exposure limits

METHYL METHACRYLATE

Long-term exposure limit (8-hour TWA): WEL 50 ppm 208 mg/m³

Short-term exposure limit (15-minute): WEL 100 ppm 416 mg/m³

METHACRYLIC ACID

Long-term exposure limit (8-hour TWA): WEL 20 ppm 72 mg/m³

Short-term exposure limit (15-minute): WEL 40 ppm 143 mg/m³

WEL = Workplace Exposure Limit

Ingredient comments WEL = Workplace Exposure Limits

8.2. Exposure controls

Protective equipment

Appropriate engineering Controls Provide adequate general and local exhaust ventilation.

Eye/face protection Eyewear complying with an approved standard should be worn if a risk assessment indicates eye contact is possible. The following protection should be worn: Chemical splash goggles.

Hand protection	Wear protective gloves made of the following material: Rubber or plastic.
Other skin and body protection	Wear apron or protective clothing in case of contact.
Hygiene measures	Provide eyewash station and safety shower. Keep away from food, drink and animal feeding stuffs. Good personal hygiene procedures should be implemented. Wash hands and any other contaminated areas of the body with soap and water before leaving the work site. Do not eat, drink or smoke when using the product. Change work clothing daily before leaving workplace.
Respiratory protection	If ventilation is inadequate, suitable respiratory protection must be worn. Wear a respirator fitted with the following cartridge: Organic vapour filter.

SECTION 9: Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Appearance	Paste.
Colour	White/off-white.
Odour	Slight pungent.
pH	pH (diluted solution): 30.-3.5 5%
Initial boiling point and range	101°C @
Flash point	10°C TCC (Tag closed cup).
Evaporation rate	3 (butyl acetate =1)
Upper/lower flammability or explosive limits	Upper flammable/explosive limit: 12.5 Lower flammable/ explosive limit: 2.1
Vapour pressure	28 mmHg @ °C
Vapour density	>1
Relative density	1.03 @ 20 ºC°C
Viscosity	40,000-60,000 cP @ 25°C

9.2. Other information

Other information	Not available.

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity	The following materials may react with the product: Strong oxidising agents. Strong reducing agents.

10.2. Chemical stability

Stability	Stable at normal ambient temperatures and when used as recommended. May polymerise.

10.3. Possibility of hazardous reactions

Possibility of hazardous reactions	May polymerise.

10.4. Conditions to avoid

Conditions to avoid Avoid heat, flames and other sources of ignition. Avoid excessive heat for prolonged periods of time. Avoid exposure to high temperatures or direct sunlight. Heating may generate flammable vapours. Vapours may form explosive mixtures with air.

10.5. Incompatible materials

Materials to avoid Avoid contact with the following materials: Oxidising agents. Reducing agents. Alkalis -inorganic. Alkalis - organic.

10.6. Hazardous decomposition products

Hazardous decomposition products Oxides of carbon. Thermal decomposition or combustion may liberate carbon oxides and other toxic gases or vapours.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity - oral

ATE oral (mg/kg) 10,000.0

Acute toxicity - dermal

ATE dermal (mg/kg) 22,000.0

Inhalation Vapours in high concentrations are narcotic. Symptoms following overexposure may include the following: Headache. Fatigue. Dizziness. Nausea, vomiting. Vapours in high concentrations are anaesthetic. Symptoms following overexposure may include the following: Headache. Fatigue. Dizziness. Central nervous system depression.

Ingestion Irritating. Symptoms following overexposure may include the following: Nausea, vomiting. Stomach pain.

Skin contact May be absorbed through the skin. Irritating to skin. Prolonged or repeated exposure may cause severe irritation. May cause sensitisation by skin contact. May cause sensitisation or allergic reactions in sensitive individuals.

Eye contact Irritating to eyes. A single exposure may cause the following adverse effects: Corneal damage.

Target organs Prolonged or repeated exposure may cause the following adverse effects: May cause damage to the liver and kidneys. Central nervous system Respiratory system, lungs

SECTION 12: Ecological Information

Ecotoxicity Avoid release to the environment.

12.1. Toxicity

Toxicity Not considered toxic to fish.

12.2. Persistence and degradability

Persistence and degradability Methyl methacrylate monomer : Biochemical oxygen demand within 5 days (BOD5) = .14 g/g - 0.9 g/g.

12.3. Bioaccumulative potential

Bioaccumulative potential Methyl methacrylate monomer: LC50/96h/fathead minnows = 150 ppm, LC50/96h/bluegill sunfish = 232ppm. Methyl methacrylate monomer: LC50/96h/rainbow trout = >79mg/l

12.4. Mobility in soil

Mobility	Do not discharge into drains or watercourses or onto the ground.

12.5. Results of PBT and vPvB assessment

Results of PBT and vPvB assessment This product does not contain any substances classified as PBT or vPvB.

12.6. Other adverse effects

Other adverse effects Not available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

General information Waste is classified as hazardous waste. Dispose of waste to licensed waste disposal site in accordance with the requirements of the local Waste Disposal Authority. When handling waste, the safety precautions applying to handling of the product should be considered.

Disposal methods Dispose of waste to licensed waste disposal site in accordance with the requirements of the local Waste Disposal Authority.

Waste class 08 04 09

SECTION 14: Transport information

General	No other information known.

14.1. UN number

UN No. (ADR/RID) 1133	1133
UN No. (IMDG) 1133	1133
UN No. (ICAO) 1133	1133

14.2. UN proper shipping name

Proper shipping name (ADR/RID)	ADHESIVES
Proper shipping name (IMDG)	ADHESIVES
Proper shipping name (ICAO)	ADHESIVES
Proper shipping name (ADN)	ADHESIVES

14.3. Transport hazard class(es)

ADR/RID class	3
ADR/RID subsidiary risk	
ADR/RID label	3
IMDG class	3
IMDG subsidiary risk	
ICAO class/division	3
ICAO subsidiary risk	

Transport labels

14.4. Packing group

ADR/RID packing group	II
IMDG packing group	II
ICAO packing group	II

14.5. Environmental hazards

Environmentally hazardous substance/marine pollutant
No.

14.6. Special precautions for user

EmS	F-E, S-D
Emergency Action Code	•3YE
Hazard Identification Number (ADR/RID)	33
Tunnel restriction code	(D/E)

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	No information required.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or ixture

EU legislation	Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (as amended).
Water hazard classification	WGK 1 WGH Nr. 154

15.2. Chemical safety assessment

No chemical safety assessment has been carried out.

SECTION 16: Other information

Revision date	11/06/2015
Revision	9
Supersedes date	24/11/2014
Risk phrases in full	R11 Highly flammable. R21/22 Harmful in contact with skin and if swallowed. R35 Causes severe burns. R36/37/38 Irritating to eyes, respiratory system and skin. R37 Irritating to respiratory system. R37/38 Irritating to respiratory system and skin. R43 May cause sensitisation by skin contact.
Hazard statements in full	H225 Highly flammable liquid and vapour. H302 Harmful if swallowed. H312 Harmful in contact with skin. H314 Causes severe skin burns and eye damage. H315 Causes skin irritation. H317 May cause an allergic skin reaction. H318 Causes serious eye damage. H335 May cause respiratory irritation.

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty, guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name IMPRINT STRUCTURAL ADHESIVE (ACTIVATOR)

Product number ISA1

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.3. Details of the supplier of the safety data sheet

Supplier

Poynton Ltd
Town Forge
High Street
Malmesbury
Wiltshire
SN16 9AT
+44 (0) 1666 822953
sales@imprintshoes.co.uk

1.4. Emergency telephone number

Emergency telephone +44 (0) 1666 822953

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification

Physical hazards Flam. Liq. 2 - H225

Health hazards Skin Irrit. 2 - H315 Skin Sens. 1 - H317 STOT SE 3 - H335

Environmental hazards Not Classified

Classification (67/548/EEC or 1999/45/EC) Xi;R37/38. R43. F;R11.

2.2. Label elements

Pictogram

Signal word Danger

Hazard statements

H335 May cause respiratory irritation.
H225 Highly flammable liquid and vapour.
H317 May cause an allergic skin reaction.
H315 Causes skin irritation.

Precautionary statements

P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P261 Avoid breathing vapour/spray.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P303+P361+P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P333+P313 If skin irritation or rash occurs: Get medical advice/attention.
P501 Dispose of contents/container in accordance with national regulations.

Contains

METHYL METHACRYLATE

Supplementary precautionary statements

P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P264 Wash contaminated skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P272 Contaminated work clothing should not be allowed out of the workplace.
P302+P352 IF ON SKIN: Wash with plenty of water.
P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 Call a POISON CENTRE/doctor if you feel unwell.
P321 Specific treatment (see medical advice on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362+P364 Take off contaminated clothing and wash it before reuse.
P370+P378 In case of fire: Use foam, carbon dioxide, dry powder or water fog to extinguish.
P403+P233 Store in a well-ventilated place. Keep container tightly closed.
P403+P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.

2.3. Other hazards

SECTION 3: Composition/information on ingredients

3.2. Mixtures

METHYL METHACRYLATE		**60-100%**
CAS number: 80-62-6	EC number: 201-297-1	REACH registration number: 01-2119452498-28-0000

Classification	**Classification (67/548/EEC or 1999/45/EC)**
Flam. Liq. 2 - H225 Skin Irrit. 2 - H315 Skin Sens. 1 - H317 STOT SE 3 - H335	F;R11 R43 Xi;R37/38

The Full Text for all R-Phrases and Hazard Statements are Displayed in Section 16.

SECTION 4: First aid measures

4.1. Description of first aid measures

General information	Avoid contact with eyes. Do not breathe vapour/spray. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
Inhalation	Move affected person to fresh air at once. Get medical attention if any discomfort continues.
Ingestion	Do not induce vomiting. Give plenty of water to drink. Get medical attention.
Skin contact	Remove affected person from source of contamination. Wash skin thoroughly with soap and water. Get medical attention if irritation persists after washing.
Eye contact	Remove any contact lenses and open eyelids wide apart. Continue to rinse for at least 15 minutes and get medical attention. Get medical attention if irritation persists after washing.

4.2. Most important symptoms and effects, both acute and delayed

4.3. Indication of any immediate medical attention and special treatment needed

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	Extinguish with foam, carbon dioxide or dry powder.

5.2. Special hazards arising from the substance or mixture

Specific hazards	Highly flammable Avoid breathing fire gases or vapours. Vapours are heavier than air and may spread near ground and travel a considerable distance to a source of ignition and flash back. Polymerises easily with evolution of heat.

5.3. Advice for firefighters

Protective actions during firefighting	Keep up-wind to avoid fumes. Do not use water jet as an extinguisher, as this will spread the fire. Cool containers exposed to flames with water until well after the fire is out. Control run-off water by containing and keeping it out of sewers and watercourses.
Special protective equipment for firefighters	Wear positive-pressure self-contained breathing apparatus (SCBA) and appropriate protective clothing.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions	No smoking, sparks, flames or other sources of ignition near spillage. Avoid inhalation of spray mist and contact with skin and eyes. Wear protective clothing as described in Section 8 of this safety data sheet. Provide adequate ventilation.

6.2. Environmental precautions

Environmental precautions Avoid the spillage or runoff entering drains, sewers or watercourses. Spillages or uncontrolled discharges into watercourses must be reported immediately to the Environmental Agency or other appropriate regulatory body.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up Absorb spillage with non-combustible, absorbent material. Collect and place in suitable waste disposal containers and seal securely. Containers with collected spillage must be properly labelled with correct contents and hazard symbol.

6.4. Reference to other sections

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Usage precautions Provide adequate general and local exhaust ventilation. Observe any occupational exposure limits for the product or ingredients. Take precautionary measures against static discharges. Storage tanks and other containers must be earthed. No smoking, sparks, flames or other sources of ignition near spillage. Good personal hygiene procedures should be implemented.

7.2. Conditions for safe storage, including any incompatibilities

Storage precautions Store in tightly-closed, original container in a dry, cool and well-ventilated place.

7.3. Specific end use(s)

SECTION 8: Exposure Controls/personal protection

8.1. Control parameters

Occupational exposure limits

METHYL METHACRYLATE

Long-term exposure limit (8-hour TWA): WEL 50 ppm 208 mg/m³
Short-term exposure limit (15-minute): WEL 100 ppm 416 mg/m³
WEL = Workplace Exposure Limit

8.2. Exposure controls

Protective equipment



Appropriate engineering Controls	Provide adequate general and local exhaust ventilation. Observe any occupational exposure limits for the product or ingredients.
Eye/face protection	Eyewear complying with an approved standard should be worn if a risk assessment indicates eye contact is possible. Unless the assessment indicates a higher degree of protection is required, the following protection should be worn: Tight-fitting safety glasses.
Hand protection	Wear protective gloves made of the following material: Rubber or plastic.
Other skin and body Protection	Wear chemical protective suit.
Hygiene measures	Provide eyewash station and safety shower. Keep away from food, drink and animal feeding stuffs. Good personal hygiene procedures should be implemented. Wash hands and any other contaminated areas of the body with soap and water before leaving the work site. Do not eat, drink or smoke when using the product. Change work clothing daily before leaving workplace.
Respiratory protection	If ventilation is inadequate, suitable respiratory protection must be worn. Wear a respirator fitted with the following cartridge: Gas filter, type A2.

SECTION 9: Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Appearance	Viscous liquid.
Colour	Yellow.
Odour	Slight pungent.
pH	pH (concentrated solution): 8.5 @ 20 ºC
Initial boiling point and range	101°C @
Flash point	10.6°C
Upper/lower flammability or explosive limits	Upper flammable/explosive limit: 12.5 Lower flammable/explosive limit: 2.0
Vapour pressure	28mmHg @ °C
Relative density	.93 - 1.05 @ @ 20 ºC°C

9.2. Other information

SECTION 10: Stability and reactivity

10.1. Reactivity

10.2. Chemical stability

Stability	Stable at normal ambient temperatures and when used as recommended. Avoid the following conditions: Heat, sparks, flames. May polymerise.

10.3. Possibility of hazardous reactions

Possibility of hazardous reactions	May polymerise.

10.4. Conditions to avoid

Conditions to avoid	Heating may generate flammable vapours. Vapours may form explosive mixtures with air.

10.5. Incompatible materials

Materials to avoid	Avoid contact with oxidising agents.

10.6. Hazardous decomposition products

Hazardous decomposition products	Oxides of carbon. Thermal decomposition or combustion may liberate carbon oxides and other toxic gases or vapours. Fire or high temperatures create: Nitrous gases (NOx). Cyanides.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Skin contact	Irritating to skin. May cause sensitisation by skin contact. Prolonged or repeated exposure may cause severe irritation. May cause sensitisation or allergic reactions in sensitive individuals.
Eye contact	Irritating to eyes.

Acute and chronic health hazards	Prolonged or repeated exposure may cause severe irritation.
Target organs	Prolonged or repeated exposure may cause the following adverse effects: May cause damage to the liver and kidneys. May cause liver and/or renal damage. Central nervous system Respiratory system, lungs

SECTION 12: Ecological Information

Ecotoxicity	Avoid releasing into the environment.

12.1. Toxicity

12.2. Persistence and degradability

Persistence and degradability	Methyl methacrylate monomer : Biochemical oxygen demand within 5 days (BOD5) = .14 g/g - 0.9 g/g.

12.3. Bioaccumulative potential

Bioaccumulative potential	Avoid or minimise the creation of any environmental contamination. Do not discharge into drains or watercourses or onto the ground.

12.4. Mobility in soil

12.5. Results of PBT and vPvB assessment

12.6. Other adverse effects

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal methods	Dispose of waste to licensed waste disposal site in accordance with the requirements of the local Waste Disposal Authority.
Waste class	08 04 09

SECTION 14: Transport information

14.1. UN number

UN No. (ADR/RID)	1133
UN No. (IMDG)	1133
UN No. (ICAO)	1133

14.2. UN proper shipping name

Proper shipping name (ADR/RID)	ADHESIVES
Proper shipping name (IMDG)	ADHESIVES
Proper shipping name (ICAO)	ADHESIVES
Proper shipping name (ADN)	ADHESIVES

14.3. Transport hazard class(es)

ADR/RID class	3
ADR/RID subsidiary risk	
ADR/RID label	3
IMDG class	3
IMDG subsidiary risk	
ICAO class/division	3
ICAO subsidiary risk	
Transport labels	

14.4. Packing group

ADR/RID packing group	II
IMDG packing group	II
ICAO packing group	II

14.5. Environmental hazards

Environmentally hazardous substance/marine pollutant

No.

14.6. Special precautions for user

EmS	F-E, S-D
Emergency Action Code	3YE
Hazard Identification Number (ADR/RID)	33

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU legislation Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (as amended).

Water hazard classification WGK 1 WGH Nr:1252

15.2. Chemical safety assessment

SECTION 16: Other information

Revision date 11/06/2015

Revision 5

Supersedes date 26/02/2015

Risk phrases in full
R11 Highly flammable.
R37/38 Irritating to respiratory system and skin.
R43 May cause sensitisation by skin contact.

Hazard statements in full
H225 Highly flammable liquid and vapour.
H315 Causes skin irritation.
H317 May cause an allergic skin reaction.
H335 May cause respiratory irritation.

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty, guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Appendix M

Date: 7.5.2015 Former date: 7.5.2015

Trade name / Substance name: Nolla Antimicrobial - Hoof Care spray

SAFETY DATA SHEET

(*) concerns only chemical notification
(**) either 3.1 or 3.2 must be filled

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifier

Trade name / Substance name
Nolla Antimicrobial - Hoof care spray
Company product code
SD115
REACH Registration number
Not applicable, because the product is a mixture.

1.2 Relevant identified uses of the substance or mixture and uses advised against

The uses of the chemical	For treatment of various horse hoof diseases
Classification of economic activities (NACE) (*)	
Use categories (UC62) (*)	
The chemical can be used by the general public (*)	
The chemical is used by the general public only (*)	

1.3 Details of the supplier of the Safety Data Sheet

Supplier	Nolla Antimicrobial Oy
Street address	Viikinkaari 6
Postcode and post office	FI-0790 Helsinki
Post-office box	
Postcode and post office	
Telephone number	
Telefax	
E-mail address	info@nollaantimicrobial.com
Finnish Business ID (Y code) (*)	FI26404505

1.4 Emergency telephone number

Denmark	National emergency number: 82 12 12 12 (Giftlinjen, Bispebjerg Hospital).
Taiwan	National emergency number: 119

SECTION 2: HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

F; R11

2.2 Label elements

According to 1999/45/EC

F Flammable

R phrases

R11 Highly flammable

S phrases

S2 Keep out of the reach of children
S7 Keep container tightly closed
S13 Keep away from food, drink and animal foodstuffs
S16 Keep away from sources of ignition - No smoking

S23 Do not breathe spray
S51 Use only in well-ventilated areas

2.3 Other hazards

None.

SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

3.1 Substances (**)

3.2 Mixtures (**)

Substance name	CAS- or EC-number	REACH Registration No.	Concentration	Classification
Ethanol	64-17-5	01-2119457610-43	60-80 %	F;R11
Silver(I) chloride	7783-90-6	Biocide, not applicable	<0,1%	N;R50/53

SECTION 4: FIRST AID MEASURES

Inhalation
Remove to fresh air and keep patient at rest.
Eyes
Flush with water while holding eyelids open for at least 15 minutes. If symptoms persist, get medical attention.
Skin
If irritation is experienced, flush with water. If irritation persists, get medical attention. If skin irritation persist, seek medical attention.
Ingestion
Wash out mouth with water. Do not induce vomiting unless directed by medical personnel. Seek medical attention immediately.

SECTION 5: FIREFIGHTING MEASURES

5.1 Extinguishing media

Water spray, carbon dioxide, dry chemical or foam.

5.2 Special hazards arising from the substance or mixture

None.

5.3 Advice for firefighters

During all fire fighting activities, wear appropriate protective equipment, including self- contained breathing apparatus.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Remove all potential ignition sources. Use individual protective equipment (see chapter 8).

6.2 Environmental precautions

Prevent entry into drains and sewers, basements or confined areas in large quantities.

6.3 Methods and material for containment and cleaning up

Small spills: Wash into sewers with large amount of water.
Large spills: Ventilate area of leak or spill. Use spark-proof tools to sweep or scrape up and containerize in approved chemical waste container. Wash spill area with water.

6.4 Reference to other sections

Use individual protective equipment (see chapter 8).

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid heat, flames, sparks and other sources of ignition – no smoking. Prevent contact with eyes. Use only in well-ventilated areas.

7.2 Conditions for safe storage, including any incompatibilities

Keep away from children. Store in a well-ventilated and dry place at normal room temperature.

7.3 Specific end use(s)

None.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Exposure limit values

Ethanol	8 h = 1000 ppm; 1900 mg/m^3 15 min = 1300 ppm; 2500 mg/m^3
Silver(I) chloride	8 h = 0,1 mg/m^3

Other limit values
Not available.
DNEL
Not available.
PNEC
Not available.

8.2 Exposure controls

Appropriate engineering controls
Normal room ventilation is usually adequate under normal use. Avoid breathing product vapour. Apply local ventilation where possible.
Eye / face protection
None needed under normal use. Wear safety glasses or goggles if eye contact is possible.
Skin protection
None needed under normal use. Wear protective clothing when working with large quantities.
Hand protection
None needed under normal use. Wear impervious gloves when working with large quantities.
Respiratory protection
None needed under normal use.
Thermal hazards
This product is highly flammable.
Environmental exposure controls
Prevent entry into drains and sewers, basements or confined areas in large quantities.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on cphysical and chemical properties

Appearance	Colourless liquid
Odour	Alcohol
Odour threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	Not available.
Vapour pressure	Not available.
Vapour density	Not available.
Relative density	Not available.
Solubility(ies)	Not available.

Partition coefficient: n-octanol/water	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Explosive properties	Not available.
Oxidising properties	Not available.

9.2 Other information

None.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity

Not available.

10.2 Chemical stability

Stable under normal conditions of use.

10.3 Possibility of hazardous reactions

Not available.

10.4 Conditions to avoid

Keep away from heat, spark, flames and all other sources of ignition.

10.5 Incompatible materials

This product reacts with strong acids, strong bases, and oxidizing agents.

10.3 Hazardous decomposition products

Upon decomposition, this product evolves carbon monoxide, carbon dioxide, and/or low weight hydrocarbons.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

Ethanol	LD50 = 10 470 mg/kg (skin, rat)
Silver(I) chloride	LD50 > 5110 mg/kg (oral, rat)

Skin corrosion/irritation

Not available.

Serious eye damage/irritation

Not available.

Respiratory or skin sensitisation

Not available.

Germ cell mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

STOT-single exposure

Not available.

STOT-repeated exposure

Not available.

Aspiration hazard

Not available.

Other information

None.

SECTION 12: ECOLOGICAL INFORMATION

12.1 Toxicity

Ethanol	LC50/96h/fish = 11 200 mg/l EC50/48h/invertebrates, fresh water = 5 012 mg/l EC50/48h/invertebrates, sea water = 857 mg/l
Silver(I) chloride	LC50/96h/fish (Pimephales promelas) = 1,93 mg/l

12.2 Persistence and degradability

Ethanol	Readily biodegradable.
Silver(I) chloride	Not available.

12.3 Bioaccumulative potential

Ethanol	log Pow = 0,32; no bioaccumulation.
Silver(I) chloride	Not available.

12.4 Mobility in soil

Not known.

12.5 Results of PBT and vPvB assessment

Not known.

12.6 Other adverse effects

Not known.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Wash empty containers with water. Dispose of in accordance with federal, state, and local regulations.

SECTION 14: TRANSPORT INFORMATION

	Land transport	Sea transport	Air transport
14.1 UN number	UN1170	UN1170	UN1170
14.2 UN proper shipping name	Ethanol	Ethanol	Ethanol
14.3 Transport hazard class(es)	3	IMO Glass 3	3
14.4 Packing group	II	II	II
14.5 Environmental hazards	Not known.	Marine pollutant: No	Not known.

14.6 Special precautions for user

Not known.

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

Not known.

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Not available.

15.2 Chemical safety assessment

Not available for this mixture.

SECTION 16: OTHER INFORMATION

Indication of changes

-

Abbreviations and acronyms

None.

Key literature references and sources for data

Publicly available toxicity information. Safety data sheets of the raw materials of the mixture.

Used method in evaluating classification

Classified and labelled according to directive 1999/45/EC.

List of relevant R-and S-phrases or/and safety and precautionary statements

Relevant R phrases
R11 Highly flammable
Relevant S phrases
S2 Keep out of the reach of children
S7 Keep container tightly closed
S13 Keep away from food, drink and animal foodstuffs
S16 Keep away from sources of ignition - No smoking
S23 Do not breathe spray
S51 Use only in well-ventilated areas

Training advice for workers

Information not available.