Preventing Bovine Mastitis by a Postmilking Teat Disinfectant Containing Acidified Sodium Chlorite

J. E. Hillerton,^{*1,2} J. Cooper,^{*} and J. Morelli[†]

^{*}Institute for Animal Health, Compton, Newbury, RG20 7NN, United Kingdom

[†]Ecolab Inc., Redmond, WA

ABSTRACT

A split-herd study was performed to determine if an acidified, sodium chlorite teat disinfectant, UDDERgold Platinum Germicidal Barrier Teat Dip (UG Pt, Ecolab Inc., Redmond, WA), was effective in preventing new intramammary infections (IMI) in lactating dairy cows compared with a licensed, iodophor teat disinfectant (Iosan, Novartis Animal Health, Ltd., Whittlesford, UK), and to show that the test product was tolerated equally well by teat skin. The study lasted 114 d and covered all weather conditions. The teats of 176 cows were dipped after each milking in UG Pt and the teats of 172 cows were dipped in Iosan, the positive-control product. Routine milk samples were taken from each quarter of every cow every 4 wk. Additional samples were taken from newly calved cows joining the trial and from cows with clinical signs of mastitis. Milk samples were cultured for the presence of bacteria and the cause of clinical mastitis. Each quarter was eligible for only 1 infection during the trial. The number of clinical cases was identical in each group ($n = 13$) and the number of subclinical infections was slightly lower in the UG Pt group than in the Iosan group ($n = 27$ and 31 , respectively). These rates of infection suggest that the products did not differ in their ability to prevent a new IMI. At least 203 cows were assessed for skin integrity before the start of the trial and every 28 d throughout. The UG Pt teat dip had no adverse effects on teat condition. The prevalence of hyperkeratosis did not change with time for both groups (0.90 ± 1.08 and 0.95 ± 1.06 at wk 0 vs. 0.65 ± 0.87 and 0.49 ± 0.74 at wk 16 for fore and hind teats, respectively, for UG Pt and 1.02 ± 1.25 and 1.16 ± 1.11 at wk 0 vs. 0.51 ± 0.71 and 0.45 ± 0.65 at wk 16, respectively, for Iosan); no redness of the skin was observed in either group. Application of rec-

ommended statistical methods to demonstrate noninferiority was problematic.

Key words: National Mastitis Council protocol, teat dip, noninferiority test

INTRODUCTION

The UDDERgold Platinum Germicidal Barrier Teat Dip (UG Pt; Ecolab Inc., Redmond, WA) is a 2-component product comprising a base containing 0.64% sodium chlorite and an activator containing 2.64% lactic acid. Equal volumes of the 2 components are freshly mixed immediately before each milking session. The acidification of the chlorite releases chlorous acid and other pharmacologically active oxychlorine compounds required for the product's antibacterial efficacy. Lactic acid is antibacterial and aids skin hydration along with the 2.5% (wt/vol) glycerin in the formulation. Experimental and natural exposure trials following National Mastitis Council (NMC, 1999) protocols demonstrated that the acidified chlorite system is highly effective in preventing bovine mastitis (Drechsler et al., 1990; Boddie et al., 1994; Oliver et al., 1996).

This clinical trial was conducted to demonstrate that UG Pt is efficacious in preventing bovine mastitis under natural exposure conditions in a positive-control test. Because UG Pt is the only acidified sodium chlorite postmilking teat dip product currently registered in the United Kingdom, no directly comparable products were available to act as positive controls. Consequently, an iodine-containing product, licensed as a teat dip in the United Kingdom and used widely within the European Union, was selected for use as a positive control.

MATERIALS AND METHODS

Study Outline

A natural exposure trial was conducted modeled on the NMC protocol (Nickerson et al., 2004) using a split-herd, positive-control design comparing UG Pt, the test product, with Iosan Teat Dip (Iosan; Novartis Animal Health, Ltd., Whittlesford, UK), the positive-con-

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¹Corresponding author: eric.hillerton@dexcel.co.nz

²Current address: Dexcel Ltd., Private Bag 3221, Hamilton, New Zealand.

Table 1. Cows allocated to treatment group by yield management group and infection status at the start of the trial

Treatment ¹	Pathogen	Management group ²					
		MHC	Heifers	High	Medium	Medium/low	Low
Iosan	<i>Corynebacterium bovis</i>	2	3	9	4	8	5
	CNS	1	11	16	4	8	4
	Major ³	0	4	3	1	1	0
	Uninfected	3	15	25	3	3	2
UG Pt	<i>C. bovis</i>	1	4	8	5	7	6
	CNS	1	11	16	5	8	2
	Major	1	3	2	1	2	0
	Uninfected	4	16	26	3	3	3

¹Iosan (positive control) = Iosan Teat Dip, Novartis Animal Health Ltd., Whittlesford, UK; UG Pt (test product) = UDDERgold Platinum Germicidal Barrier Teat Dip, Ecolab Inc., Redmond, WA.

²MHC = cows of known histocompatibility type kept separate for easy management; Heifers = all first-lactation animals; High = cows yielding >30 kg of milk/d; Medium = cows yielding 20 to 30 kg of milk/d; Medium/low = cows yielding 15 to 25 kg of milk/d; Low = cows yielding <15 kg milk/d.

³*Staphylococcus aureus*, streptococci, and gram-negative bacteria.

trol product. Two treatment groups, containing approximately the same number of cows, balanced by bacteriological status, lactation stage, and parity, were established and maintained for the duration of the trial. The treatment group had 697 quarters free of infection and the control group had 683 quarters free of infection upon introduction to the trial.

Animal Supply and Management

All cows in milk at the Institute for Animal Health's Chesham Farm (Newbury, UK) were included in the trial if eligible. Eligibility required that cows be free of clinical mastitis for 21 d before the trial, not in receipt of antimicrobial treatment during the 21 d before the trial, and free of teat lesions.

Cows were managed in groups according to their production levels (Table 1). Cows of both treatment groups were mixed, bedded in sand freestalls or straw yards, and managed in an identical fashion. The lowest yielding management groups were moved to pasture in mid-April. Each production group contained approximately equal numbers of cows receiving control and test treatment products (Table 1). Cows were not sorted at milking time, but were identified by a colored leg band to indicate treatment group.

All animals were fed a TMR from common troughs, usually a mixture of corn and grass silage with additional materials to balance the energy and nutritional components. In the latter part of the trial, the lower yielding groups received only grass as forage. All cows had access to concentrated feed, via out-of-parlor feeders. Chlorinated water from the chalk strata supplied from the institute well was available ad libitum.

Allocation to Group

All lactating cows were examined for IMI using duplicate quarter samples taken 5 to 7 d before the trial. All newly calved cows were examined for IMI using duplicate quarter samples taken within 24 h of calving and then again within 7 d of calving. Infection was identified on the isolation of the same bacterial species from both samples, or from a third sample if the results differed between the first 2 (International Dairy Federation, 1981). Cows were categorized as either uninfected or infected in 1 or more quarters with *Staphylococcus aureus*, *Streptococcus dysgalactiae*, *Streptococcus uberis*, gram-negative bacteria, CNS, or *Corynebacterium bovis*. No other infections were confirmed at this time.

All uninfected cows were assigned to treatment group balancing lactation number (parity) and then lactation stage. The cows were managed in production (lactation stage) groups so that each group contained approximately the same number of cows on each treatment at approximately the same risk of infection (Table 1).

Infected cows were classified according to category of mastitis pathogen. Within each pathogen group the cows were sorted by lactation stage then by parity. These cows were assigned sequentially and randomly to either the test or control product group. Cows unpaired each week were pooled as closely as possible under the same lactation stage and sequentially and randomly assigned. All newly calved cows were added to treatment or control groups based on infection status and then parity. They were included in the first-lactation group or the high-yielding group. Until allo-

cation to treatment group, all newly calved cows were teat dipped with the control product only.

Eligibility of quarters for new infection meant that any one quarter could become infected only once by any 1 of *Staph. aureus*, *Strep. dysgalactiae*, *Strep. uberis*, gram-negative bacteria, CNS, or *C. bovis*. Duplicate quarter milk samples were taken from each cow 5 to 7 d before the start of the trial, every 28 d during the trial, and at the conclusion, and were examined to determine IMI. On confirmation of a new IMI, the quarter was excluded from eligibility for further IMI. When clinical mastitis occurred, the affected quarter was sampled for bacteriology, treated with antibiotic, and the cow excluded. Any teats showing accidental damage were excluded until integrity of the teat skin was restored.

All cows were milked in a double-8 milking parlor. The higher yielding management groups were milked thrice daily and the lower yielding groups milked twice daily. Before each milking all cows in each group had all teats dipped in water and dried with a single-service paper towel; each teat was then fore-stripped. The milk and the cow were observed for abnormal signs before the cluster was attached (NMC, 1999).

Products and Administration

The test product components (activator and base) and the control product (Iosan) were stored at ambient temperature before use. The UG Pt product was prepared fresh before each milking by combining the activator and base in equal volumes and mixing thoroughly to a uniform color. The mixed test disinfectant was placed in clean, dry, nonreturn teat-dip cups for application to the teats. The control disinfectant was ready to use and was the product normally used in the herd. Teats were dipped to at least 50% of the teat length as soon as possible following removal of the cluster.

The quantity of product applied to each teat was estimated by preparation of teat cups containing test or comparator product, weighed when full and then again after dipping all teats of subgroups of 4 cows of a total of 20 cows treated with each product.

Teat Condition Scoring

A minimum of 203 cows, selected from the higher yielding management groups (including heifers), was assessed for skin integrity (Mein et al., 2001) 3 d before the trial started and then every 28 d during the trial. These animals included the cows that had most recently calved; cows in this group were milked thrice daily and were most likely to show a response in teat

skin to treatment. Inspection determined skin coloration, skin roughness, and orifice condition for hyperkeratosis. The particular traits of relevance that were scored were skin surface, as normal, dry, or rough; skin color, as normal, reddened, or otherwise discolored; and hyperkeratosis on a scale of none (0) to extremely rough (5).

Laboratory Procedures

All milk samples were examined for pathogenic bacteria (International Dairy Federation, 1981). Subclinical infections were defined based on the same bacteria identified from each duplicate sample or in 1 sample at each of 2 consecutive samplings. To be eligible the quarter had to be free of the identified pathogen in the pretrial sampling.

Statistical Methods and Assessment

The statistical methods recommended in the NMC protocol (Nickerson et al., 2004) were followed to compare the relative proportions of new IMI or clinical mastitis occurring in quarters treated with the test or comparator product.

The Z-value for the comparison was calculated together with its relative probability. This allowed comparisons between the 2 products to determine if one was superior to the other. A 95% one-sided lower limit confidence interval (LLCI) for the difference between proportions was calculated using the normal approximation and the critical one-tailed Z value of 1.645. Statistics were determined as follows:

Letting:

x_1 = number of new IMI in control quarters,
 x_2 = number of new IMI in treated quarters,
 n_1 = number of eligible control quarters, and
 n_2 = number of eligible treated quarters,

then calculating:

p_1 (fraction of new IMI in control quarters) = x_1/n_1 ,
 p_2 (fraction of new IMI in treated quarters) = x_2/n_2 ,
 p (pooled infection proportion) = $(x_1 + x_2)/(n_1 + n_2)$,

$Z = [p_1 - p_2] / \sqrt{[p \times (1 - p)/n_1 + p \times (1 - p)/n_2]}$,
 $LLCI = [p_1 - p_2] - 1.645 \times \sqrt{[p \times (1 - p)/n_1 + p \times (1 - p)/n_2]}$.

The proportion of infections in quarters treated with UG Pt was then compared with the proportion of infections in quarters treated with Iosan by estimating the magnitude of the difference between these propor-

Table 2. Number of eligible new IMI and bacteriologically positive quarters

Type of new IMI	Pathogen					No pathogen found
	<i>Staphylococcus aureus</i>	<i>Streptococcus dysgalactiae</i>	<i>Streptococcus uberis</i>	Gram-negative bacteria	Other	
Subclinical	5	3	17	3	4	0
Clinical case	1	2	5	7	4	7
Total	6	5	22	10	8	7

tions, based on the observed values. The following formula was used:

$$\text{Best estimate of the difference} = (p1 - p2)/p1 \times 100.$$

Because this estimate was calculated using observed values, there is a possibility that it was arrived at by chance. To determine confidence in this result, the LLCI (at the 95% level) was used to calculate the potential difference between proportions in a “worst-case scenario” (i.e., at the lower level of the confidence interval). The following formula was used: Largest possible difference (at 95% LLCI) = LLCI/ $p1 \times 100$.

Teat condition was compared by ANOVA to determine any difference by treatment and time.

RESULTS

Use of Product

The amount of disinfectant used per cow ($\pm$ SD) was 10.3 ± 4.0 g of Iosan and 11.4 ± 7.2 g of UG Pt.

Allocation of Cows

A total of 348 cows met all eligibility criteria and were allocated to one of the treatment groups. The groups were balanced as closely as possible for age, stage of lactation, and infection status (Table 1). During the trial period, 24 cows were excluded because of incomplete or insufficient udder health data or because they were being treated with antibiotics for nonmastitis infections. Cows were removed from the trial at dry-off or when mastitis was detected (uncontrollable removal). Sufficient data for study inclusion were collected for 176 cows teat dipped with UG Pt and 172 cows teat dipped with Iosan.

Infections

Streptococcus uberis caused more than half of all subclinical infections (Table 2). Gram-negative bacteria were the most common cause of clinical mastitis (27%) with no pathogen isolated from 27% of cases. No significant differences were found between treatment groups in causes for either new infections or clinical mastitis.

Simple statistical analyses (Z-tests) show no differences in the rate of clinical mastitis or the occurrence of subclinical mastitis with respect to treatment (Table 3). Hence, one product was not superior to the other. This outcome is not sufficient to demonstrate equivalence or noninferiority.

Estimated differences between the proportions of infected quarters in both treatment groups were calculated based on observed values, which indicated that the proportion of infected quarters was slightly higher (23.8%) in the Iosan group than in the UG Pt group (Table 4). When the LLCI was used to predict the largest possible difference between the proportion of infected quarters, the true proportion of infections in the Iosan-treated group might be lower (27.1%) than in the UG Pt-treated group. Nonetheless, if this value falls within the limits of acceptable difference, the treatments could still be considered equivalent.

Teat Condition

Teat condition was scored for cows milked thrice daily and all recently calved cows—the highest at-risk groups for new IMI and changes in teat condition. Cows were not allocated to treatment based on teat condition, so the pretrial scores simply reflect the random assignment of cows.

Table 3. Summary of new IMI for cows treated with UG Pt or Iosan teat dips¹

Teat dip	Cows allocated to treatment, n	Eligible quarters, n	New subclinical IMI, n	New clinical IMI, n	Total new IMI, n
UG Pt	176	697	14	13	27
Iosan	172	683	18	13	31

¹Iosan (positive control) = Iosan Teat Dip, Novartis Animal Health Ltd., Whittlesford, UK; UG Pt (test product) = UDDERgold Platinum Germicidal Barrier Teat Dip, Ecolab Inc., Redmond, WA.

Table 4. Statistical analysis of IMI for cows treated with UG Pt or Iosan teat dip¹

New infection type	Z-statistic	Probability of Z	LLCI ²	Observed difference in proportion of infected quarters (Iosan vs.UG Pt) ³	Largest possible difference in proportion of infected quarters (Iosan vs. UG Pt) ⁴
				(%)	
Subclinical IMI	0.7736	0.2196	-0.00713	+23.8	-27.1
Clinical IMI	0.0522	0.4792	-0.01173	+2.0	-61.5
Total IMI	0.6156	0.2691	-0.01122	+14.7	-24.7

¹Iosan (positive control) = Iosan Teat Dip, Novartis Animal Health Ltd., Whittlesford, UK; UG Pt (test product) = UDDERgold Platinum Germicidal Barrier Teat Dip, Ecolab Inc., Redmond, WA.

²LLCI = 95% one-sided lower limit confidence interval for the difference between proportions.

³Calculated using the formula: difference = $(p1 - p2)/p1 \times 100$, where p1 = proportion of infected quarters in Iosan-treated group and p2 = proportion of infected quarters in UG Pt-treated group.

⁴Calculated using the formula: largest possible difference = $LLCI/p1 \times 100$, where p1 = proportion of infected quarters in Iosan-treated group.

Initial hyperkeratosis scores were not different between fore and hind teats ($P > 0.07$) for cows dipped with Iosan (Table 5). Scores did not change with time for both treatment groups and were never significantly different. Redness of the skin was not observed in either treatment group (Table 6). At 4 wk a small increase in number of cows with skin dryness was found in both groups, but not found later. A leathery appearance of the teat skin increased slightly in number of teats dipped with UG Pt only at 4 wk. Weather data from the local meteorological station showed that the first 4 wk of the trial were the wettest and coldest conditions of the year, providing the biggest weather challenge to teat-skin condition. Overall, the trial was conducted during a wide range of climatic conditions (a period below freezing to a period of warm weather, combined with wet and dry periods) typical of those in the south of the United Kingdom.

DISCUSSION

Efficacy

The herd efficacy study was managed carefully, with strict attention to the methods used and the exclusion of cows. This reduced the number of cows eligible, but the rigor contributed to a high confidence in the accuracy of the data.

The groups dipped with UG Pt or Iosan had few new IMI (Table 3). It is important that Iosan resulted in such a low rate because this suggests that the product was a highly effective positive control and hence, a true measure of equivalence for UG Pt. The eligible cows suffered clinical mastitis at a rate equivalent to 23 cases/100 cows per year. If ineligible cows were included, the herd rate over the adverse housing period would be equivalent to 33 cases/100 cows per year, about 75% of the national annual average (Kossaibati

and Esslemont, 1997), suggesting that the test was conducted in a herd already maintaining good management and hygiene. The rate of clinical mastitis was determined with high accuracy, whereas the detection rate in commercial herds may have an error of underestimation approaching 50% (Dodd et al., 1969).

Statistical methods for assessing noninferiority in clinical efficacy trials are still very much in the development stage, and there is no recommended method entirely suited to teat-dip research. The NMC-recommended statistical analysis provides an appropriate tool to assess whether one treatment is superior to another (Z-test), but it is not appropriate for assessing noninferiority. This is because the guidelines do not provide recommendations for defining an acceptable margin of difference between the 2 treatments, delta (Δ). Lower level confidence intervals were calculated in accordance with NMC guidelines. All calculated values were small and negative (Table 4), but the various guidelines are unclear as to how such values should be handled and offer conflicting statements in relation to their interpretation.

The European Agency for the Evaluation of Medicinal Products (EMA) has produced guidelines relating to the analysis of noninferiority trials (EMA, 2005). They suggest that to demonstrate noninferiority, a value of Δ should be chosen before the study onset as the maximum acceptable difference between the 2 treatments. If an appropriate margin were chosen, then a confidence interval that lies entirely between $-\Delta$ and 0 (i.e., the test product is inferior to the reference product) or not more than Δ (the reference product is inferior to the test product) would be adequate to demonstrate noninferiority.

The EMA (2005) suggests that to demonstrate noninferiority, a Δ may be constructed which summarizes the information known about the relative efficacy of

Table 5. Hyperkeratosis scores¹ ($\pm$ SD) by treatment group and for fore and hind teats for the duration of the trial for cows treated with UG Pt or Iosan teat dip

Time (wk)	Group ²								
	Iosan			UG Pt			Newly calved and not yet allocated		
	Fore	Hind	n	Fore	Hind	n	Fore	Hind	n
0	1.02 (1.25)	1.16 (1.11)	80	0.90 (1.08)	0.95 (1.06)	69	0.90 (1.31)	0.94 (1.19)	55
4	0.71 (1.02)	0.67 (0.86)	97	0.96 (1.06)	0.87 (0.91)	85	0.23 (0.36)	0.14 (0.73)	41
8	0.67 (0.90)	0.71 (0.86)	97	0.85 (0.92)	0.69 (0.76)	103	0.19 (0.54)	0.10 (0.36)	21
12	0.52 (0.73)	0.37 (0.67)	103	0.54 (0.72)	0.48 (0.72)	100	0.15 (0.38)	0.08 (0.29)	13
16	0.51 (0.71)	0.45 (0.65)	104	0.65 (0.87)	0.49 (0.74)	105	1.25 (1.15)	2.0 (1.53)	4

¹Scored on a scale of none (0) to extremely rough (5).

²Iosan (positive control) = Iosan Teat Dip, Novartis Animal Health Ltd., Whittlesford, UK; UG Pt (test product) = UDDERgold Platinum Germicidal Barrier Teat Dip, Ecolab Inc., Redmond, WA.

the test and comparator products. Because this was the first study of its kind using the test product, such information was not available. According to Gomberg-Maitland et al. (2003), it is preferable that the value of Δ is established by independent expert consensus. Subsequent to this study, the EMEA now advises that Δ may be determined from historical data using the same or a similar reference product tested in trials of a similar size and over a similar period (EMA, 2005).

Despite the lack of a predefined Δ value, it is clear from the observed results that the incidence of clinical and subclinical mastitis was virtually identical in the UG Pt and Iosan groups. Hence, it is reasonable to assume that the treatments are at least equivalent.

In the absence of a predefined value of Δ agreed by an independent expert consensus, an alternative approach to assessing noninferiority might be to compare the results of the current study with those of a study with a similar design, whose conclusion was that 2 treatments were similar. The work of Hogan et al. (1995) is cited as an example of noninferiority testing in the NMC-recommended protocols (Nickerson et al., 2004). That trial showed that for a number of bacterial

classes, there was no difference between the control and test products in terms of the proportion of infected quarters. With this in mind, the data presented by Hogan et al. (1995) were used to calculate the largest possible difference in proportion of infected quarters, based on the LLCI at 95%, for each of the bacterial classes in which the authors had concluded that there was no difference between treatments. This calculation was performed in the same way as for values given in Table 4 in this report. The resulting values were -20.8% for *Staph. aureus*, -17.5% for streptococci, -52.3% for gram-negative bacteria, and -19.4% for yeasts.

In the absence of any direction as to the value that should be used for Δ , it would seem reasonable to use a value that falls within the range of these values (i.e., between -17.5% and -52.3%) because the values were generated by a study of similar design. If the midpoint of this range were selected, this would equate to $-\Delta$ being set at around -35%. This is consistent with the recent EMA advice (EMA, 2005) validating the approach used here to confirm noninferiority of the test product.

Table 6. Skin condition (number of teats) by treatment group for the duration of the trial for cows treated with UG Pt or Iosan teat dip¹

Time (wk)	Skin redness		Slight dryness		Slight leatheriness		n
	Iosan	UG Pt	Iosan	UG Pt	Iosan	UG Pt	
0	0	0	0	2	0	0	203
4	0	0	4	3	1	4	223
8	0	0	1	0	0	1	221
12	0	0	0	0	0	0	216
16	0	0	0	0	0	0	215

¹Iosan (positive control) = Iosan Teat Dip, Novartis Animal Health Ltd., Whittlesford, UK; UG Pt (test product) = UDDERgold Platinum Germicidal Barrier Teat Dip, Ecolab Inc., Redmond, WA.

The largest possible difference in the proportion of infected quarters in the Iosan treated group relative to the UG Pt group could have been as much as -27.1% for subclinical infections or -24.7% for the total number of infections (Table 4). If $-\Delta$ is set at -35%, then UG Pt is clearly not inferior to Iosan in terms of the proportion of subclinical or total infections, because the largest possible difference in proportions falls between $-\Delta$ and 0.

This argument highlights major difficulties in that no clear precedents exist to define Δ for this kind of study, and that products that are believed at least equivalent require substantiation for an absurd value of Δ . The observed difference in the proportion of teats that developed clinical mastitis between the 2 groups was very small. However, this difference could potentially be as large as -61.5% when the lower level confidence interval is taken into account (Table 4). This value lies beyond the value we have arbitrarily selected for $-\Delta$, despite the incidence of clinical cases (13) being the same in both groups. These tests appear more appropriate for testing equivalence when products are relatively ineffective than for testing noninferiority when the products are highly effective. For example, had each treatment resulted in 50 cases of mastitis rather than 13, then the largest potential difference between the number of infections would have been -29.5%, which would fall within our chosen limits of equivalence. A high power requires a trial with a large sample size mitigated in part by use of the noninferiority comparison. Large trials are not usually practical, being limited by herd size and the economic value of product testing compared with the value of the market for a licensed product.

It is important that consensus is reached on appropriate statistical methods for comparative trials of teat disinfectants to satisfy regulatory authorities. The Z-statistic may be usable in large-scale human trials; hence its adoption by EMEA and others, but it is not practical for experimental testing of teat disinfectants on grounds of feasibility and cost, because it relies on the proportion of infections and sample size, without taking account of time. If 2 products were truly equivalent, the proportion of infections should become more similar with time.

Teat Condition

The UG Pt product had no deleterious effects on teat condition. The degree of hyperkeratosis varied somewhat between determinations, but the cows examined were a dynamic sample from a dynamic population. Overall, the amount of hyperkeratosis decreased with each treatment with time. Significant

care was necessary in the preparation of teats dipped with UG Pt in the determination of hyperkeratosis. If the teat ends were not cleaned properly, extra material was felt by touch around the orifice; this material proved to be dried UG Pt.

Redness of the skin was not observed on teats in either group. Some dryness of the teat barrel skin was found 4 wk after the start of the field trial, and was similar for both treatment groups; this quickly disappeared. The only skin thickening, leatheriness, was found in the first half of the trial and on very few cows (more so on those cows dipped in UG Pt). Some skin reaction is not unusual when the teat dip is changed to one of a different chemical formulation, and in this case, a very mild hyperplasia occurred. Previous experience suggests that this leatheriness was trivial and quite unlike the frequency or degree found with hypochlorite-based disinfectants. The slight deteriorations in skin condition coincided with a period when ambient temperatures were lowest. Such changes are common following a change to a new product.

CONCLUSIONS

This herd efficacy study shows that the probability of teats becoming infected when using either UG Pt or Iosan is low. The UG Pt product is at least equivalent to Iosan in controlling IMI over several months under all weather conditions likely to be experienced in a UK dairy herd, including periods of grazing and complete housing using sand or straw bedding. No deleterious effects were found on teat condition, and no observations of any limitations in its use on cows or by staff were reported.

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