Evaluation of a Novel Chlorine Dioxide Teat Dip on Teat End and Teat Skin Health

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Summary and Implications

The purpose of this study was to evaluate the teat end health and skin conditioning performance of an experimental "no mix" chlorine dioxide teat dip vs. the commercial dips and best management practices used at the ISU Dairy using a split udder design. The experimental chlorine dioxide dip showed similar, excellent teat skin health and conditioning compared to the herd's dips and best management practices. However, average teat end scores and % rough teats were significantly higher in chlorine dioxide dipped teats, with this reaction occurring more on teats that had higher hyperkeratosis at the start. This localized, prolonged reaction on that subset of animals and teats should be evaluated and further rectified to assure similar excellent teat end health compared to industry standards and best management practices. There were also marked changes in scores and similar trends across groups and products signifying that other factors besides teat dips influence teat health.

Introduction

Maintaining good teat end and teat skin health is recognized as an important element in mastitis prevention and animal welfare. In addition to excellent germicidal activity, all potentially new teat dips should have both teat end and teat skin health data evaluation, and show excellent teat health prior to commercialization. An experimental teat dip was developed utilizing a "no-mix" chlorine dioxide germicidal technology with 15% skin emollients. The purpose of this study was to evaluate the teat end health and skin conditioning performance of the experimental chlorine dioxide dip vs. the commercial dips and best management practices used at the ISU Dairy using a split udder design. A split udder design study was performed to minimize risk of experimental bias and maximize chances of seeing teat dip effects.

Materials and Methods

A teat dip trial was conducted at the Iowa State Dairy Farm from late August through early November 2007 with protocols approved by the Iowa State University Committee on Animal Care. In addition, data was collected from another similar lactating cow group and the fresh cow pen where all teats were dipped with the standard pre-milking and post-milking teat dip products used at the farm.

An experimental teat dip utilizing a "no mix" chlorine dioxide germicidal mode and containing 15% emollients was evaluated (Boumatic, Madison, WI). The herd standard post-milking teat dip used was a 0.5% iodine, 10% emollient product (Quadraplex ,IBA), while the pre milking teat dip was a 0.25% iodine, 2% skin conditioning product (BacStop, IBA).

The trial used a split udder design. Left teats of 56 cows (Pen 1 Free Stalls- high production string) were pre and post dipped with current herd dips (control) while right side teats were dipped with the chlorine dioxide dip (treatment). Pen 2 was another 56 cow, high production string while the fresh cow pen housed 20-25 animals who were < 30 days post calving. Cows were milked twice a day in a double 8 herringbone parlor. Cows were forestripped (3 strips/teat) and pre-dipped (4 cow sequence), then dried with terry cloth prior to milker unit attachment. Automatic detachers were set at 1.5 lb. flow rate and 2 second delay. All pens were housed in free stall barns with sand bedded stalls. Pen 1 animals had a 100 yard walk (open environment travel lane) to their barn but feeding was inside the barn. Pen 2 had a 30 yard walk (open environment travel lane) and feeding mangers were outside the barn while the fresh cow barn had a 50 yard walk and outside feed bunks.

Data collection was initiated on August 27 and continued until Nov. 14. Test products were applied starting August 31 or on the 5th^{h} day of the trial following 2 baseline evaluations. Teat skin and teat end scoring was performed using a variation of the Goldberg and Timms methods, respectively, by trained graders (Tables 1 and 2). Scoring was performed twice per week. Results were compiled and analyzed using SAS. Teat end and skin scores were analyzed using a 2 sample t-test while proportion of rough/cracked teat ends were analyzed using a 2 sample test of equality of proportions.

Results

Average teat skin and teat end results, and % of cracked/rough teat ends for the trial group (Pen 1) are presented in Figures 1and 2, respectively. There were no significant differences in teat skin score between treated and control teats, and skin condition was excellent (mean near score 1). Within 3 days of dipping, average teat score started to trend higher with significantly higher average teat end scores in treated vs. control quarters by 6 days post dipping through the end of the trial. This difference was associated with significant increases in the percentage of rough/ cracked teat ends over the trial period in treated vs. control teats (Fig. 2).

Average teat skin and teat end results, and % of cracked/rough teat ends for Pen 2 and the fresh cow pen (internal herd control pens) are presented in Figures 3-4, and 5-6, respectively. There were no differences in average teat end or skin scores, or percentage of rough/ cracked teats between udder halves in both groups. Teat end/skin scores and % rough teats in these groups were similar to the control teats (same dips) in the trial group or pen.

There were significant teat changes across udder halves and time, signifying other factors beside dips contributing to teat condition issues also.

Discussion

Overall, teat skin scores and condition were similar across all pens and dips with excellent teat skin conditioning shown throughout the whole trial. Average teat end scores and percentage of rough/ cracked teats were significantly higher in teats with the experimental dip compared to control herd dip within one week following initiation of experimental dip use and remained significantly greater throughout the whole trial. It has been stated that chlorine dioxide dips show increased roughness and teat end skin sloughing ~ 1 week after dip introduction, possibly resulting from dead skin exfoliation, followed then by excellent teat end health. This roughness was seen in this trial by one week but persisted throughout the trial and did not resolve. The roughness and increased percentage of rough teat ends tended to present itself and prolong on teats that had more hyperkeratosis(score 2-3 teats) initially compared to normal (teat score 1-2) teats, visually looking like some localized residual irritation on this population of teats, possibly resulting from the concentrated drop at the end of the teat following dipping.

There were no differences seen between udder halves and teats in the 2 within herd control pens, and no difference between these groups and the control teats (same herd dip). The score trends between and within groups are remarkably similar and suggest that some factors beyond the teat dip was having a significant influence on the teat ends, or that there is a degree of self benchmarking by the grader between study groups on any particular grading period.

Conclusions

The experimental chlorine dioxide teat dip showed excellent teat skin health and conditioning, and no difference with control dips and best management practices. However, average teat end scores and % rough teats were significantly higher in chlorine dioxide dipped teats, with this reaction occurring more on teats that had higher hyperkeratosis at the start. This localized, prolonged reaction on that subset of animals and teats should be evaluated and further rectified to assure similar excellent teat end health compared to industry standards and best management practices.

Marked changes in teat end scores were measured over time and over periods as short as days. On the other hand, product treatment comparisons frequently showed parallel trends in score averages, respective of dip. This illustrates the importance of a split udder design to evaluate skin conditioning performance. The split udder design minimizes the risk of experimental bias due to cow and environmental factors. Most reported teat skin studies rely on comparing teat dips in separate cow groups with little consideration to group balancing even though factors such as hyperkeratosis is known to be affected by cow age and lactation stage. This study illustrates the high risk of traditional design skin toleration studies inaccurately attributing effects to teat dips.

Table 1.Teat Skin Scoring Scale.

Score	Description
0	Teat skin has been subjected to physical injury (stepped on/ frost bite)
1	Teat skin is smooth, soft and free of any scales, cracks, or chapping.
2	Teat skin shows some evidence of scaling especially when feeling (areas of dryness by feeling drag when sliding a gloved hand along the teat barrel &/or seeing areas of lower reflective sheen to the surface of the skin).
3	Teat skin is chapped. Chapping is where visible bits of skin are visibly peeling.
4	Teat skin is chapped and cracked. Redness, indicating inflammation, is evident.
5	Teat skin is severely damaged / ulcerated / open lesions.

Table 2. Teat End Scoring Scale (0-5).

Teat End Scoring system	**Degree of hyperkeratosis or callousing**				
Cracking	none	minor	mild	moderate	severe
No cracking	1	1.5	2	2.5	3
Cracked	---	3.5	4	4.5	5

* zero score – physical injury of teat

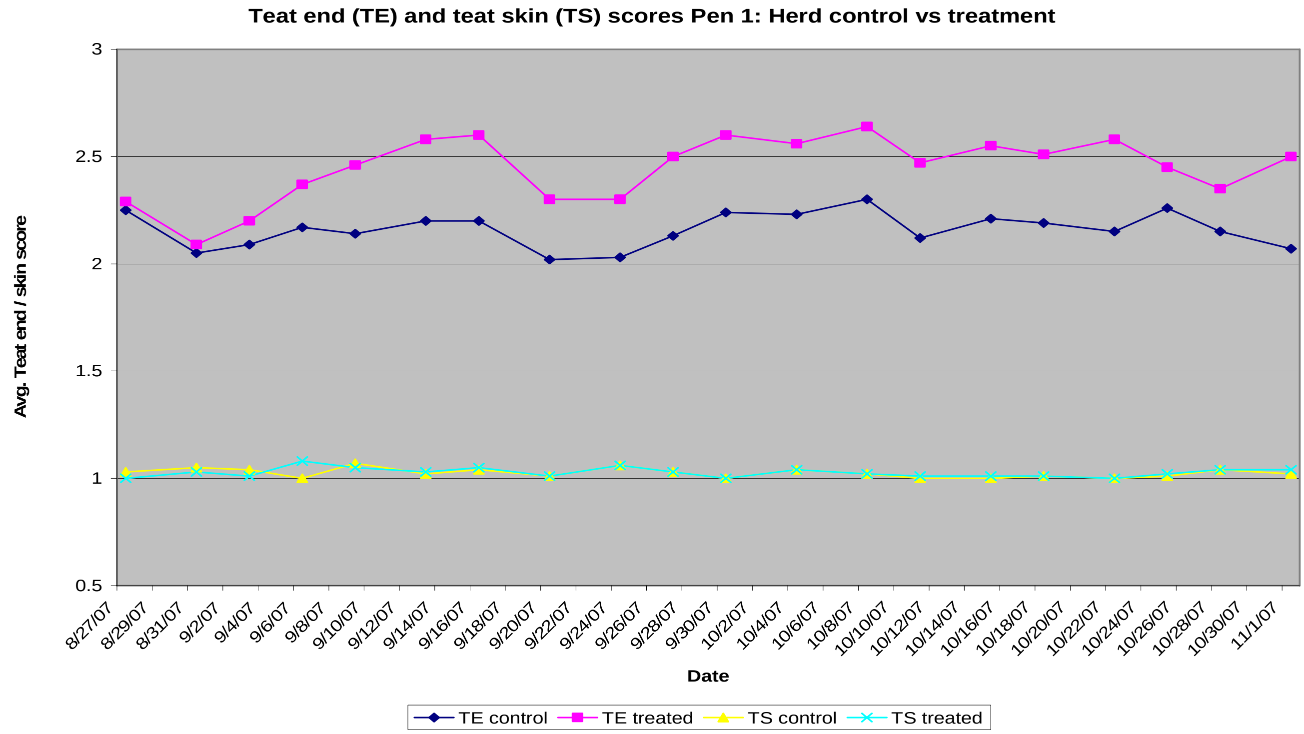

Figure 1. Average Teat Skin (TS) and Teat End (TE) scores for control teats (left side teats – herd dips) and treated teats (right side teats – chlorine dioxide experimental dip).

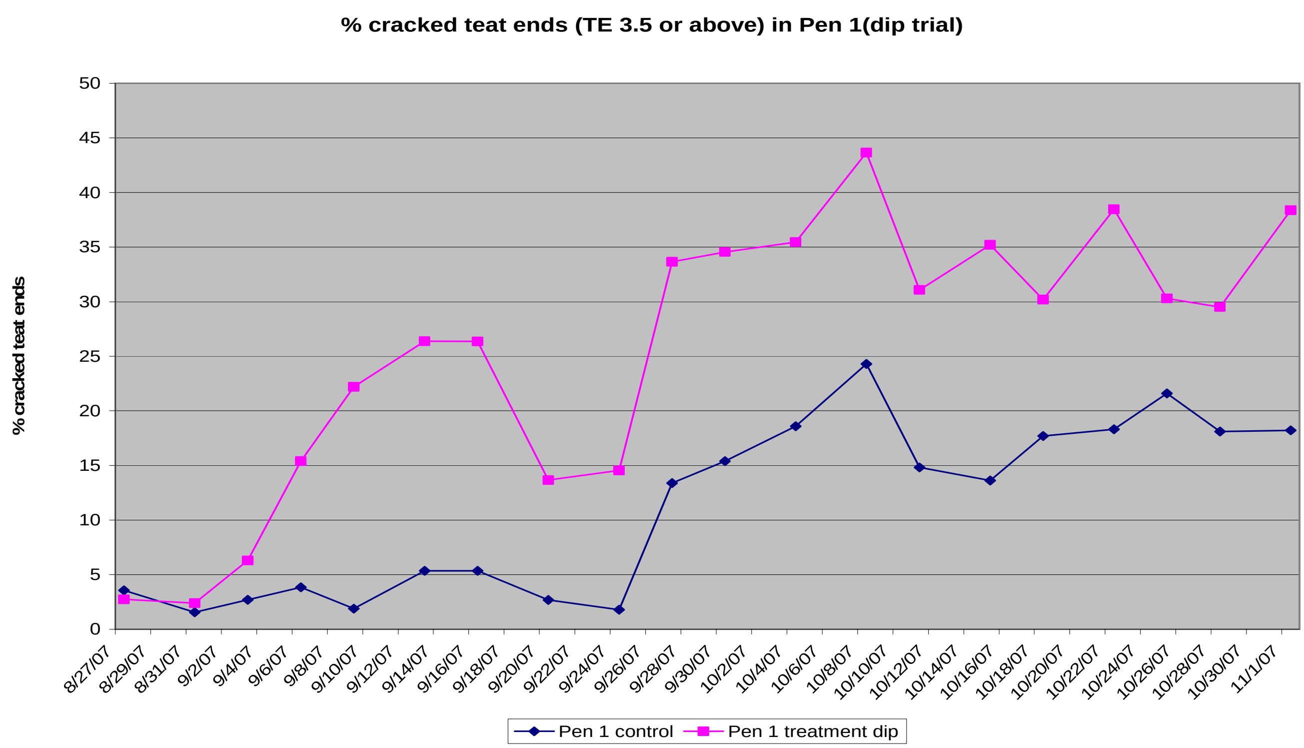

Figure 2. Average percentages of cracked / roughened teat ends for control teats (left side teats – herd dips) and treated teats (right side teats – chlorine dioxide experimental dip).

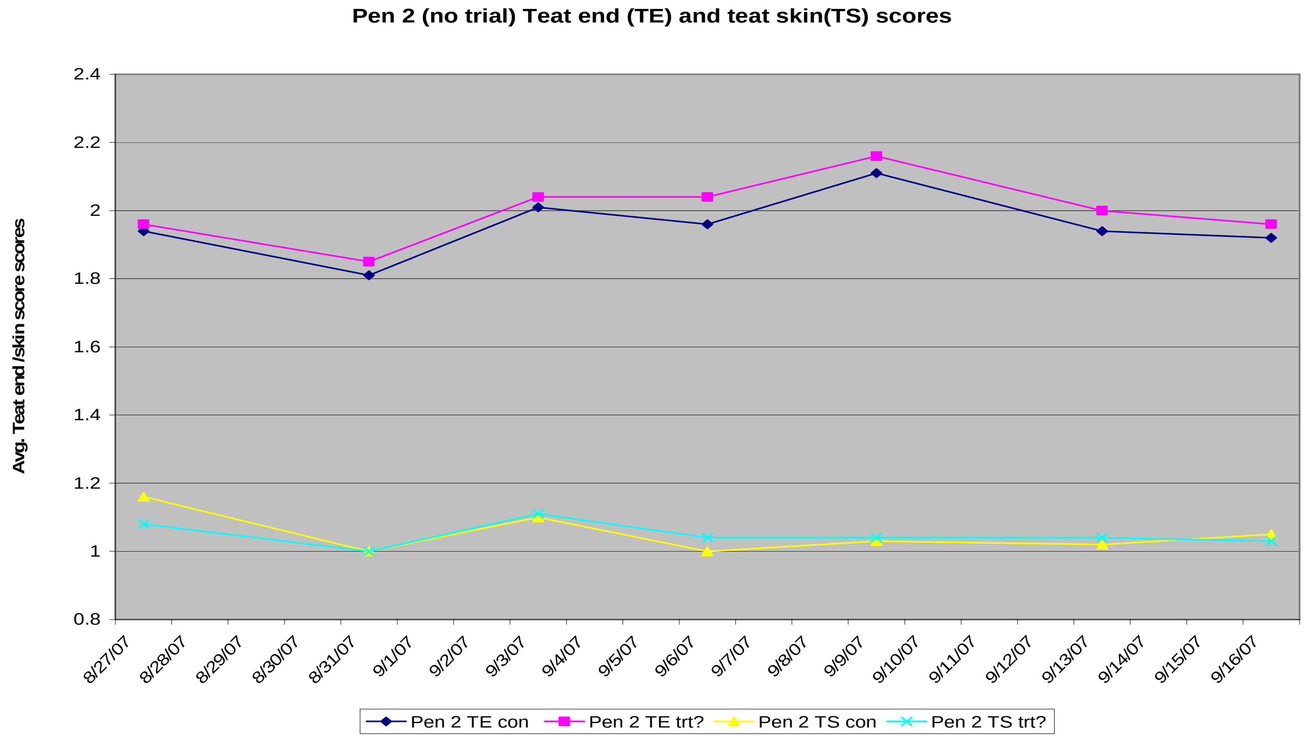

Figure 3. Average Teat Skin (TS) and Teat End (TE) scores for Pen 2 (both sides dipped with herd dips).

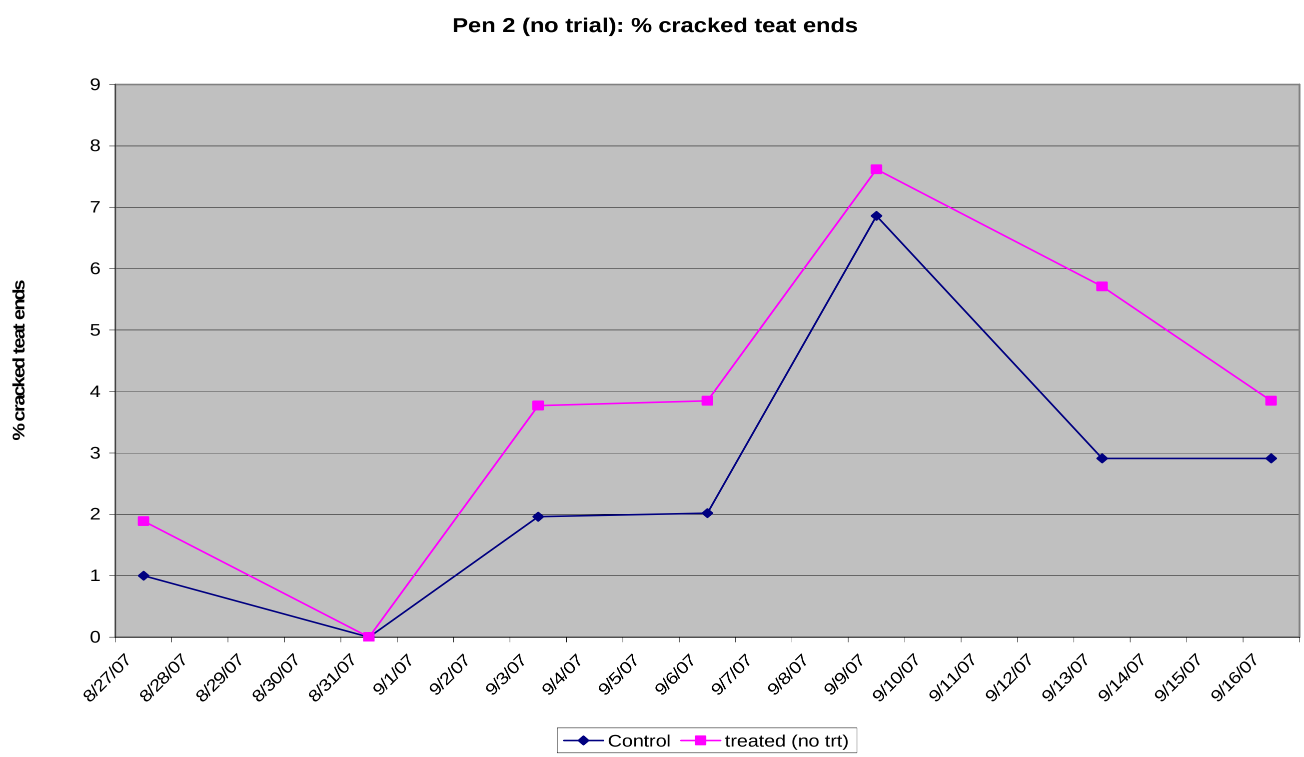

Figure 4. Average percentages of cracked / roughened teat ends for Pen 2 (both sides dipped with herd dips).

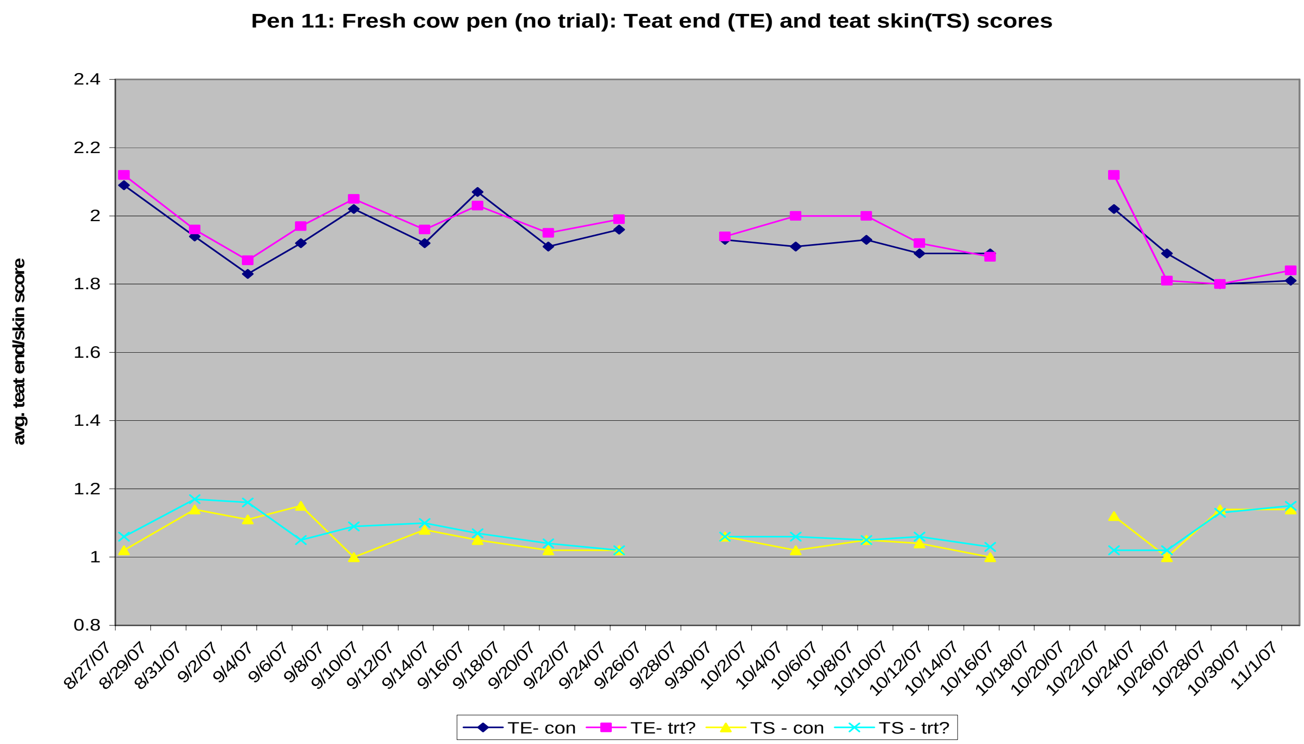

Figure 5. Average Teat Skin (TS) and Teat End (TE) scores for Pen 11 – fresh cows (both sides dipped with herd dips).

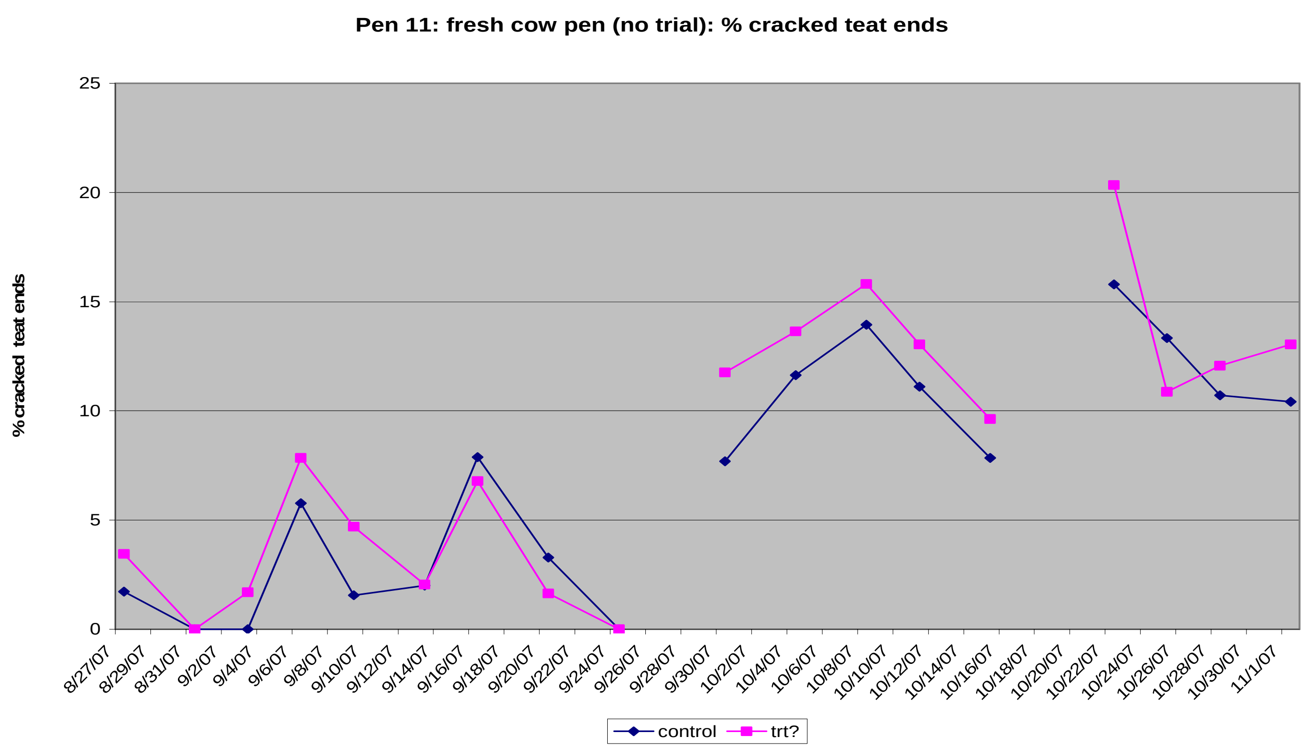

Figure 6. Average percentages of cracked / roughened teat ends for Pen 11 – fresh cows (both sides dipped with herd dips).