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# Subjective Evaluation of Teat Canal Anatomy

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# Subjective Evaluation of Teat Canal Anatomy[1]

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**Abstract**

Since radiographic techniques have shown that streak canals with larger diameters tend to milk-out faster and are more susceptible to new intramammary infections, a practical visual test was sought to provide easier determination of cows with either extremely narrow (slow milking) or extra wide (susceptible to new infections) streak canals.

A subjective teat classification scheme was developed to describe five different teat-end shapes in 159 Holstein and Brown Swiss cows in the University of Nebraska dairy herd. Approximately one-fourth of the cattle had pointed or round teat ends, one-half had flat or near flat, and one-fourth were either disk or cone-shaped at the distal end.

The correlation coefficient of repeated observations varied between .67 and .84, generally increasing as the time span between observations shortened. About 40% of variation in future classification scores is unaccounted for by past classification scores and may be the result of human error. I conclude, however, that this teat classification scheme has sufficient repeatability as an aid to selection, especially in springer heifers close to freshening.

## Introduction

Nearly all intramammary infections occur as a result of microorganisms passing through the teat canal. Anatomical differences in teat structure are related to susceptibility to infection (6). It appears that the anatomical feature contributing most to susceptibility is the width of the canal rather than its length.

If the lower end of the teat canal has a wide diameter (>1.00 mm), infection more likely occurs than if this area is narrow (<0.55 mm) (2, 6). Dilation of the teat canal is also related to increased milk-flow rate, and quarters with high milk-flow rates appear to be more easily infected (1, 2).

Both McDonald (4, 5) and Appleman (1) have published reports characterizing anatomy of the teat by radiographic processes. Appleman also related his results, in a preliminary study, to a subjective visual teat classification. He found teats classified as disk or cone-shaped had wider streak canals than pointed or round. Flat teats were intermediate in diameter of streak canal (1).

My study determined repeatability of subjective visual evaluation. Of particular interest was the change that might occur if animals were evaluated as heifers prior to freshening, as dry cows, or before rather than after milking. This may be important because cows' teats become more dilated as lactation progresses and with successive lactations (1, 4, 5). Change in teat structure after classification of teats on heifers would negate the value of visual evaluation in characterizing internal teat anatomy as it relates to both rate of milking and resistance to intramammary infection.

## Experimental Procedure

A subjective teat classification, modified from that of Johansson (3), was developed for the five primary teat-end shapes shown in Fig. 1. Since, in some cases, it was arbitrary whether a teat should be placed in one classification or another, a numerical scheme was devised allowing the rating to be intermediate between two classes and also facilitating statistical analysis (Table 1).

Since selection of an animal involves all four teats, an average score was determined for each animal at each stage of development. Evaluations were: heifers, 60 to 120 days prepartum; springer heifers, less than 60 days prepartum; dry cow score, cow dry after previous lactation and less than 90 days before subsequent freshening; first score after freshening, scored immediately after milking and between 7 and 60 days post-freshening; pre-milk score, immediately before milking; and post-milk score, immediately after milking.

## Results and Discussion

If a subjective teat classification scheme is

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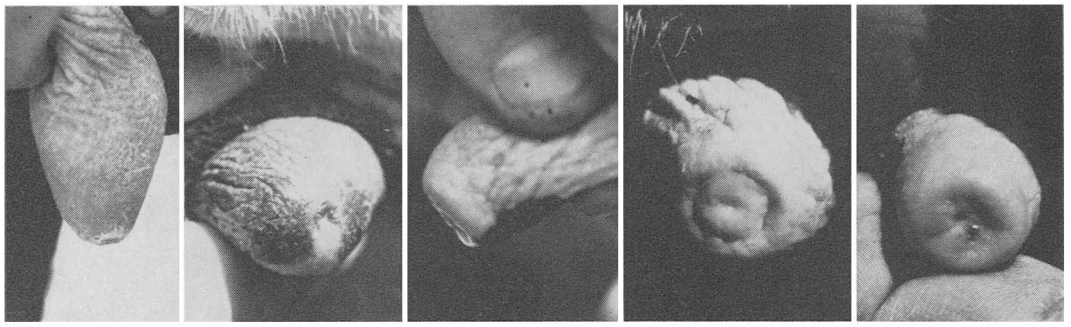


FIG. 1. Examples of the 5 primary teat-end classifications.

to have practical value in selecting herd replacements that both milk-out reasonably fast and are suitably resistant to new intramammary infections, repeatability of evaluations made at different times must be high enough to result in confidence in the judgment of the evaluator. It appears that either the evaluator changes his classification score or animals change with time and stage of development. Both may be involved.

Repeated evaluations of cows and bred heifers a few days apart resulted in correlations of only .78 and .75, respectively, suggesting that 40% or more of variation in future classification scores is unaccounted for by past classification scores and may result from human error. On the other hand, a comparison of data in Table 2 suggests that as the interval is lengthened and the associated stage of development becomes more varied, the correlation between repeated measurements is lowered even further.

Comparisons in Table 2 are in order of increasing time between the two evaluations. With one exception involving the dry cow, the closer the time the higher the correlation coefficient. One possible explanation for the unexpected lower correlaton involving dry cows is that several cows were making udder in preparation for parturition at the time of evaluation; perhaps the fully distended teats resulted in abnormal shapes until after freshening.

Type scores of springer heifers within 60 days of calvings were more consistent with post-freshening scores than those of heifers from 60 to 120 days pre-parturition. Teat development on heifers more than 4 mo prepartum was too immature and variable for

TABLE 1. Numerical assignment of classification scores to various types of teat ends, with selected examples of interacted scoring.

| Teat classification[a] | Numerical score | Written description |
|---|---|---|
| Pointed (P) | 10 | .. |
| Round (R) | 20 | .. |
| Flat (F) | 30 | .. |
| Disk (D) | 40 | .. |
| Cone (C) | 50 | .. |
| Fr | 27 | Flat with tendency toward roundness (30−3 = 27) |
| Rf | 23 | Round with tendency toward flatness (20+3 = 23) |
| Fd | 33 | Flat with tendency toward disk-shaped end (30+3 = 33) |
| Fc | 36 | Flat with tendency toward cone-shaped end (30+3+3 = 36)[b] |

[a] Upper case letters are the primary evaluation; lower case letters are a secondary classification utilized when the evaluator is uncertain about primary classification.

[b] Secondary evaluation is 2 steps removed from primary classification.

TABLE 2. Means, standard deviations, and correlation coefficients of different pairs of teat classification scores.

| Stage of development | Mean Score | $\sigma$ | R | Mean interval between observations | Animals |
|---|---|---|---|---|---|
| | | | | (days) | (no.) |
| Pre-milk | 27.7 | 6.7 | .84 | 0 | 159 |
| Post-milk | 29.0 | 7.3 | | | |
| Springer heifers | 29.9 | 8.2 | .77 | 60 | 53 |
| After freshening | 29.0 | 7.6 | | | |
| Heifers | 28.9 | 8.7 | .76 | 60 | 40 |
| Springer heifers | 30.2 | 7.9 | | | |
| Dry cow | 30.7 | 6.9 | .67 | 90 | 29 |
| After freshening | 31.7 | 6.5 | | | |
| Heifers | 28.8 | 7.8 | .70 | 120 | 55 |
| After freshening | 29.0 | 7.1 | | | |

an evaluator to make good judgments. This suggests that dairymen purchasing replacements cannot select younger animals and expect to determine accurately milking characteristics.

An inspection of postpartum data on springer heifers did not reveal significant differences between classification groups in teat scores shifting after freshening. All groups tended to shift negatively; however, there was a tendency for more cows with pointed and rounded teats to shift downward.

Data showing relation of the teat classification to flow rate are in Table 3. Differences between type classification in average flow rate and peak flow rate were statistically significant ($P < .01$). Cows with pointed and round teats showed no significant difference in either flow rate measurement. But only a limited number of cows were in the pointed classification. All other groups differed ($P < .05$) in observed flow rate.

TABLE 3. Flow-rate measurement by teat classification group.

| | Teat classification[a] | | | |
|---|---|---|---|---|
| | Pointed | Round | Flat | Disk or cone |
| No. cows | 9 | 24 | 20 | 17 |
| Av. flow rate (kg/min) | 2.51 | 2.69 | 2.93 | 3.97 |
| Peak flow rate (kg/min) | 3.36 | 3.46 | 3.81 | 5.06 |

[a] Based on the average score of four teats on each cow.

McDonald (6) has shown that teat canals with larger diameters are more susceptible to new intramammary infections. The only criteria for presence of infection in my study was monthly California Mastitis Test (CMT) results. By limiting CMT comparisons to 53 first calf heifers (fall, 1971 calvings) in the first 5 mo of lactation, many other environmental influences were minimized. No differences between teat classification groups were observed.

Approximately 50% of the animals in each group had at least one positive CMT score (of 2 or 3) sometime during the first five tests.

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