

Effect of 'tongue tie' use on racing performance of Thoroughbreds in the United Kingdom

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Summary

Reasons for performing study: There is contradictory published evidence on the potential efficacy of 'tongue ties' (TTs) for treatment of intermittent dorsal displacement of the soft palate (DDSP) in racehorses.

Objectives: To evaluate the effect of TTs on racing performance in Thoroughbred racehorses in the UK using a retrospective cohort study.

Methods: Data on individual horses' lifetime racing performance and TT use were retrieved from the Racing Post Online Database. Exposed cases were horses that ran with a TT in randomly chosen race meetings on one of 60 randomly chosen dates from 2001–2003. Unexposed (control) horses were matched to each exposed horse. Various measures of racing performance were analysed both within and between exposed and unexposed groups. Subsets of exposed horses that ran for 3 or 5 consecutive starts wearing TTs and their matched controls were analysed separately to examine the effect of repeated TT use.

Results: The inclusion criteria were fulfilled by 108 horses. The odds ratio for 'improvement' in race earnings between exposed and unexposed horses was 1.85 for horses that ran at least once with a TT, and 3.60 and 4.24, respectively, for horses that ran in 3 or 5 consecutive races wearing a TT. After instigation of TT use, horses that ran in 3 or 5 consecutive races wearing a TT had a significant increase in earnings when they ran wearing a TT compared to their pre-TT races.

Conclusions and potential relevance: The use of a TT appears to have a beneficial effect on racing performance in a selected population of Thoroughbred racehorses.

Introduction

The prevalence of 'tongue tie' (TT) use in Thoroughbred racing in the UK is reported to be 5.0% (Barakzai *et al.* 2009a). The principal indications for use of TTs are for treatment of suspected intermittent dorsal displacement of the soft palate (DDSP) or occasionally purportedly to improve the jockeys' control of horses that get their tongues over the bit during racing.

Despite their widespread use, there is contradictory evidence in

the scientific literature regarding the potential efficacy of TTs for treatment of DDSP. Franklin *et al.* (2002) found that TTs prevented DDSP from occurring in only 2 out of 6 clinically affected horses. These authors also recorded that time to fatigue and ventilatory parameters were not significantly improved in these 2 horses despite the fact that DDSP did not occur. Cornelisse *et al.* (2001a) found no significant effect of TT use on either nasopharyngeal diameter or hyoid position, although these experiments were performed in normal horses under general anaesthesia, which is not representative of the situation in exercising horses with DDSP. Other studies have shown no beneficial effect of TTs on upper airway mechanics (inspiratory and expiratory airflow and resistance, tidal volume and respiratory rate) in normal (Cornelisse *et al.* 2001b) or normal, sternothyroid myectomised (Beard *et al.* 2001) horses exercising on the treadmill.

To date there are only 2 reports investigating the potential effect of TTs on racing performance of horses clinically affected with DDSP (Barakzai and Dixon 2005; Barakzai *et al.* 2009b), in which 53–61% of horses improved their earnings following instigation of conservative treatments for DDSP. However, TT use was only one of a variety of conservative treatments evaluated in these reports and, additionally, the frequency of TT use during racing was not evaluated specifically using retrospective racing records. In the UK it is a requirement that all TT use during Thoroughbred racing is declared to the British Horseracing Authority, therefore TT use is reliably recorded.

Evaluation of the effect of TT use on racing performance may lend support for the continued use of TTs during racing in horses suspected to be afflicted with DDSP or alternatively may provide objective scientific evidence that there are no measurable performance-related benefits associated with their application.

The aim of this study was to evaluate the effect of TTs on racing performance in Thoroughbred racehorses in the UK using several different performance-related parameters.

Materials and methods

Data acquisition

A retrospective cohort study was performed utilising data on individual horses' lifetime racing performance and TT use retrieved from the Racing Post Online Database (www.racingpost.co.uk).

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Identification of exposed horses (horses wearing 'tongue ties' during racing)

Race meetings were chosen at random from 60 randomly assigned dates between January 2001 and December 2003 (Barakzai *et al.* 2009a). Horses were selected as potential exposed 'cases' if they ran in a race at one of the randomly chosen race meetings held between 2001–2003 wearing a TT. The lifetime racing history of the horse was then examined to ensure that the horse complied with the following selection criteria: 1) horses must have had at least 5 starts prior to first use of a TT during racing; 2) in order to ensure that true 'lifetime' race records were analysed, horses were excluded if they had raced during the 18 months prior to 1st August 2008, i.e. if there was a reasonable possibility that they were still racing or in training at the time of data acquisition; 3) horses were excluded if they had starts before 1st January 1999 because the Racing Post database did not record TT use prior to this date; and 4) if the same horse was found to run with a TT at more than one race meeting, it was used only once for statistical analyses.

Selection of unexposed ('control') horses (horses not wearing a 'tongue tie')

The unexposed 'control' horses were those that did not race using a TT during their racing career. Unexposed horses were selected randomly from the race in which the case horse first ran with a TT, and were matched to the case horse for gender and age. Two unexposed horses were matched to each exposed horse. If an exact age- or gender-matched control could not be found, a control that was one year older or younger or of a different gender was chosen. If 2 matched controls were not available for an individual exposed horse, then only one control horse was used. Lifetime racing history of control horses was examined to ensure that controls had started in 5 races prior to the date of the first race that their matched exposed horse ran in using a TT and that they never raced with a TT in place.

The performance of exposed and unexposed horses were analysed in 3 groups with the following inclusion criteria: *Group 1* included all exposed horses that wore a TT at least once and their

matched controls (unexposed horses); *Group 2* included only exposed horses that ran with a TT in place for at least 3 consecutive races after first use of a TT during racing and their matched controls (unexposed horses); and *Group 3* included only exposed horses that ran with a TT in place for at least 5 consecutive races after first use of a TT and their matched controls (unexposed horses).

Therefore, horses that were included in *Group 2* were a subset of *Group 1*, and horses included in *Group 3* were a subset of both *Groups 1* and *2*.

Data collection and analyses

The total (lifetime) number of starts prior to and after the date of first use of the TT was ascertained for exposed and unexposed horses. The race earnings (prize money won) for 5 starts immediately before and after the date of the first TT use was also recorded.

Descriptive statistics (range, median and mean) were calculated for continuous variables including age, number of starts prior to the date of first race wearing a TT, number of starts 12 months after the date of the first race wearing a TT and lifetime starts after first use of a TT. Frequency distribution for gender and whether the horse ran in National Hunt or flat races at the time of first TT use was also described.

Analyses of performance measures

Race starts: Linear regression (with a 'group' variable indicating which exposed and unexposed horses were matched included as a random effect) was used to compare the total number of race starts prior to the date of the first race with a TT, in the 12 months after this date and for the total (lifetime) number of races after date of initial use of the TT, between exposed and unexposed horses.

Race earnings: An improvement in total earnings was defined as a horse having increased total earnings in either 3 or 5 races after date of initial application of the TT during racing as compared to 3 or 5 races prior to initial application of the TT. The change in total earnings was determined by subtracting the total earnings prior to

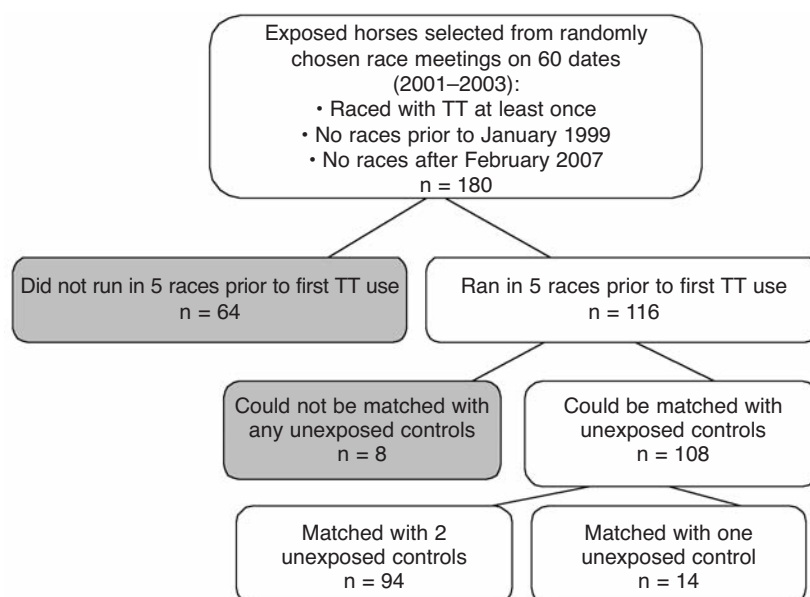


Fig 1: Flow chart showing number of potential exposed and unexposed horses that were excluded at various stages of the selection process. Shaded boxes denote horses that were not included for statistical analyses.

tongue tie application from the total earnings post tongue tie application. Improvement in earnings for 3 (*Groups 1, 2, and 3*) and 5 (*Groups 1 and 3*) races before and after first TT use was analysed as a binary outcome (improved = 1, no improvement = 0) using univariable conditional logistic regression. Total earnings (as a continuous variable) for 3 (*Groups 1, 2 and 3*) and 5 (*Groups 1 and 3*) races before and after this date were compared between exposed and unexposed groups using linear regression (with 'exposed' or 'unexposed' included as a random effect) and within exposed and unexposed groups using the Wilcoxon signed rank tests.

Statistical significance was set at a P value of ≤ 0.05 . All statistical tests were performed in Stata 10.0 statistical software and Microsoft Excel.

Results

Inclusion of exposed and unexposed horses

The numbers of horses excluded because they did not comply with various inclusion criteria are shown in Figure 1. The numbers of exposed and unexposed horses included in each of *Groups 1, 2 and 3* for further analyses are shown in Table 1. The number of consecutive race starts with a TT for exposed horses is shown in Table 2.

Case subject details

The subject details of horses in the 3 groups was very similar: exposed horses in *Groups 1, 2 and 3* included 76.7%, 77.8% and 75.0% geldings and 23.3%, 22.2% and 25.0% mares, respectively. Mean age was 4.6, 4.8 and 4.7 years for cases in *Groups 1, 2 and 3*, respectively (range 2–10, median 4 for all groups). Unexposed horses were matched preferentially on gender and age, therefore the unexposed population was comparable to that of the exposed horse population: for unexposed horses, the percentages of geldings in *Groups 1, 2 and 3* were 82.7%, 79.9% and 76.8% and of mares was 17.3%, 20.1%, and 23.2% and the mean age of unexposed horses in the 3 groups was 4.6, 4.8 and 4.7 years, respectively (range 2–9, median range 4–5).

In *Group 1*, 56 (52%) horses raced in flat races and 52 (48%) in National Hunt races at the time of first tongue tie use. In

TABLE 1: Number of exposed and unexposed horses included in groups 1, 2 and 3

	No. of exposed horses	No. of unexposed horses	Total no. of horses
<i>Group 1</i>	108	202	318
<i>Group 2</i>	72	134	206
<i>Group 3</i>	52	99	151

TABLE 2: Number of consecutive race starts wearing a 'tongue tie' after first application for all exposed horses

Consecutive starts with TT	No. of horses (% of total horses)
1	26 (24.1%)
2	10 (9.3%)
3	13 (12.0%)
4	7 (7.4%)
5	52 (48.1%)
Total	108 (100%)

Group 2, 36 (50%) raced on the flat and 36 (50%) in National Hunt races, and in *Group 3*, 25 (48%) raced on the flat and 27 (52%) raced in National Hunt races.

Race starts

A comparison of the mean numbers of race starts prior to and after the date of first TT use for the 3 groups of horses is shown in Table 3. In all groups, exposed horses started in significantly fewer races prior to the date of first application of a TT than unexposed horses (*Group 1* P = 0.0001, *Group 2* P = 0.002, *Group 3* P = 0.05).

In all groups, there was no significant difference in the lifetime number of starts after the date of the first TT use (*Group 1* P = 0.09, *Group 2* P = 0.55, *Group 3* P = 0.53). In *Groups 2 and 3*, exposed horses accumulated significantly more starts (*Group 2* P = 0.05, *Group 3* P = 0.001) than their matched unexposed controls in the initial 12 months after first TT use. However, there was no significant difference in the number of starts in the initial 12 months after the date of the first TT use between exposed and unexposed horses in *Group 1* (P = 0.42).

Analysis of race earnings

Table 4 shows raw earnings data for exposed and unexposed horses in *Groups 1, 2 and 3*.

Improvement in earnings (binary outcome)

The percentage of horses that improved their earnings in 3 or 5 starts pre- and post the date of first use of a TT for each of the 3 groups of horses are shown in Table 5.

Group 1 (all exposed and unexposed horses)

Horses that wore a TT were 1.85 times more likely than unexposed horses to have improved earnings in 3 races after the date of initial use of a TT compared to the 3 races prior to this date (P = 0.01,

TABLE 3: Mean number of race starts prior to the date of first race with a 'tongue tie' (pre TT), in the initial 12 months after first use of (initial 12 months post TT) and the total number of lifetime starts after first use of a TT for 3 groups of horses

Group		Mean number	Mean number	Mean number
		of starts pre TT (range, median)	of starts initial 12 months post TT (range, median)	of lifetime starts post TT (range, median)
1	Exposed horses	11.6* (5–42, 9)	9.6 (1–25, 9)	21.3 (1–90, 19)
	Unexposed horses	15.8* (1–76, 13)	9.1 (1–25, 9)	25.2 (1–129, 18.5)
2	Exposed horses	12.1* (5–36, 10.5)	10.1* (2–25, 9)	21.6 (3–90, 19)
	Unexposed horses	15.8* (1–61, 13)	8.7* (1–25, 8)	23.3 (1–129, 17.5)
3	Exposed horses	12.5* (5–36, 11)	11.2* (2–25, 10.5)	23.7 (5–90, 20)
	Unexposed horses	14.9* (1–50, 13)	8.6* (1–23, 8)	21.7 (1–96, 13)

*Denotes statistically significant difference between no. of races run by exposed and unexposed horses in this group.

TABLE 4: Raw earnings data for exposed and unexposed horses in Groups 1, 2 and 3

Group		Mean total earnings over 3 races pre TT (range, median)	Mean total earnings over 3 races post TT (range, median)	Mean total earnings over 5 races pre TT (range, median)	Mean total earnings over 5 races post TT (range, median)
1	Exposed horses	2489 (3–39320, 272)	5299 (1–247989, 1048)	4815 (5–140635, 709)	7881 (1–5285, 1491)
	Unexposed horses	3053 (1–72173, 402)	3715 (1–106000, 861)	4684 (1–118130, 1487)	5609 (1–187919, 1907)
2	Exposed horses	2249 (3–39320, 3)	3958 (3–63201, 1496)	n/a	n/a
	Unexposed horses	2656 (1–56201, 364)	3637 (1–106000, 558)	n/a	n/a
3	Exposed horses	1609 (3–18004, 3)	3165 (3–18962, 1615)	2368 (5–18006, 376)	5483 (5–43429, 2886)
	Unexposed horses	1898 (1–29751, 338)	2193 (1–49046, 496)	3219 (1–34688, 950)	3677 (1–79744, 1292)

95% CI 1.16–2.96). There was no significant difference between exposed and unexposed horses when the improvement in earnings in 5 races after initial application of a TT was compared to 5 races prior to this date (OR 1.44, 95% CI 0.89–2.31, $P = 0.14$).

Group 2 (horses that started in at least 3 consecutive races wearing a TT and matched unexposed horses)

Horses that wore TTs were 3.6 times (95% CI 1.89–6.84) more likely than matched unexposed horses to have improved earnings 3 races after the date of initial application of a TT ($P < 0.0001$).

Group 3 (horses that started in at least 5 consecutive races wearing a TT and matched unexposed horses)

Horses that wore TTs were 4.24 times (95% CI 1.90–9.45) more likely than matched unexposed horses to have improved earnings over 3 races ($P < 0.0001$) and were 5.05 times (95% CI 2.04–12.53) more likely to have improved earnings over 5 races ($P < 0.0001$) after the date of initial use of a TT.

Comparison of earnings (continuous variable) between exposed and unexposed horses

When earnings were analysed as a continuous variable, there was no significant difference between exposed and unexposed horses in any group either prior to or after the date of first TT use (all P values > 0.05).

Comparison of earnings (continuous variable) within exposed and unexposed horses

Within *Group 1*, there was no significant difference between the total earnings in 3 or 5 races pre- compared with the total earnings in 3 or 5 races after the date of first use of a TT for both case (3 race $P = 0.66$, 5 race $P = 0.12$) or control (3 race $P = 0.62$, 5 race $P = 0.27$) populations.

For horses that started in a minimum of 3 or 5 consecutive races (*Groups 2 and 3*) wearing a TT, a significant increase in earnings was observed during the period of consecutive TT use ($P < 0.0001$ for all analyses). No significant difference was observed in pre-vs. post date of first TT application earnings for matched unexposed horses in either of these groups (*Group 2*: 3 race $P = 0.78$; *Group 3*: 3 race $P = 0.80$, 5 race $P = 0.87$).

Discussion

Experimental evidence has suggested that use of a TT does not improve physiological measures of respiratory function in horses (Beard *et al.* 2001; Cornelisse *et al.* 2001a,b; Franklin *et al.* 2002). To date, most experimental studies have evaluated clinically normal horses, and not those with suspected or confirmed DDSP (Beard *et al.* 2001; Cornelisse *et al.* 2001a,b). Clinical studies that evaluated racing performance in suspected and confirmed cases of DDSP evaluated TT use grouped together with other conservative treatments, rather than evaluating TT use specifically (Barakzai and Dixon 2005; Barakzai *et al.* 2009b). No other study to date has evaluated the effect of TT use on racing performance *per se*, regardless of the indication for using a TT. The data here appear to show that TT use has a beneficial effect on racing performance in selected horses that are perceived by their trainer to be afflicted with DDSP or which are run with a TT in place to improve jockey control, and that this beneficial effect on racing performance is particularly marked for horses that run in at least 3 or 5 consecutive races wearing a TT.

Only 108 of an initial 180 horses identified as racing wearing a TT at least once fulfilled case definition criteria for inclusion in the analyses performed in this study. The large drop-out rate was primarily due to horses that did not have a full 5 race history prior to the first application of a TT ($n = 64$). It is possible that the elimination of these horses may introduce some bias to the study; however, we wished to have a baseline of pre-TT earnings in order to evaluate if exposed horses showed improved performance after instigation of TT use.

TABLE 5: Percentage of horses that improved their earnings when 3 and 5 starts before and after initial use of a 'tongue tie' are compared

		% Horses with improved earnings 3 races	% Horses with improved earnings 5 races
<i>Group 1</i>	Exposed horses	56.5 (61/108)	59.3 (64/108)
	Unexposed horses	40.6 (82/102)	50.5 (102/202)
<i>Group 2</i>	Exposed horses	69.4 (50/72)	n/a
	Unexposed horses	38.1 (51/134)	n/a
<i>Group 3</i>	Exposed horses	71.2 (37/52)	76.9 (40/52)
	Unexposed horses	38.4 (38/99)	46.5 (46/99)

Comparison of the findings of *Groups 1, 2 and 3* revealed several trends in performance parameters that may have been present in *Group 1*, but became statistically significant or more strongly significant when the exposed case definition criterion was made more rigorous, i.e. included only horses that ran in several consecutive races wearing a TT (*Groups 2 and 3*), rather than including horses that may have run without a TT for some of their races (*Group 1*). Horses in *Groups 2 and 3* were selected subsets of *Group 1*, and the improvement in performance observed in *Groups 2 and 3* is probably a consequence of this highly selected population; i.e. individual horses that performed well initially when wearing a TT were likely to continue to race with it in place for several consecutive races and, in these horses, the TT appears to have exerted a beneficial effect on performance. Those horses in which initial TT use was not perceived to improve racing performance probably ran wearing a TT in fewer consecutive races and therefore horses in which the TT was deemed ineffective were likely to be eliminated from *Groups 2 and 3*.

The percentage of all cases that improved their earnings after first use of a TT was 56.5–59.3%, which is comparable with the previously reported figures for use of a variety of conservative measures to treat DDSP (53–61%; Barakzai and Dixon 2005; Barakzai *et al.* 2009b). However, when the TT was used persistently, a higher percentage of horses improved their earnings (69.4–76.9%). Horses in *Groups 2 and 3* ran in significantly more races in the 12 months following TT application than their matched unexposed controls, and the OR for 'improvement' in earnings over 3 races between exposed and unexposed horses increased from 1.85 in *Group 1*, to 3.60 in *Group 2* and 4.24 in *Group 3*. In contrast, a comparison of earnings analysed as a continuous variable did not reveal any differences between cases and controls in any of the groups. This difference is probably attributable to the non-normal distribution of earnings data and also the fact that the binary outcome method takes into account not just race earnings, but also the number of races run. Comparison of earnings as a continuous variable within cases and controls in *Groups 1, 2 and 3* revealed that only cases in *Groups 2 and 3* increased their earnings significantly after instigation of TT use as compared to their pre-TT performance. These results indicate that the effect of running with a TT is beneficial but, in particular, horses that are selected to run repeatedly wearing a TT appear to experience a beneficial effect on their individual performance in comparison to horses where the TT was used only once, or intermittently.

Horses that ran with TTs had a comparable number of lifetime race starts after instigation of TT use as matched unexposed controls, therefore the use of a TT should not be viewed as detrimental to the longevity of a racehorse's career. The pattern of repeated use of a TT in a high percentage of horses (TT applied in a median 92% of races in the first year after initial use; Barakzai *et al.* 2009a) suggests that owners/trainers do indeed perceive that there is a beneficial effect of the TT on racing performance for selected horses. Our study, using objective measures of performance (increased number of race starts in the first 12 months after first TT use, exposed horses significantly more likely to have improved earnings in up to 5 races post TT use than unexposed horses, earnings increased significantly within exposed horse groups when pre- and post TT earnings compared), has now provided

data that appear to support this anecdotal evidence regarding TT use.

The reasons for the reported beneficial effects of TT use on racing performance are unclear. We did not investigate the reasons for TT application in this study; hence we do not know what proportion of exposed horses were wearing TTs to prevent DDSP vs. those wearing TTs for managemental reasons. It is possible that the experimental evidence provided thus far in normal or myectomised horses (Beard *et al.* 2001 Cornelisse *et al.* 2001a,b) is not representative of the situation in exercising horses with naturally occurring DDSP. Larger studies that expand upon the preliminary work by Franklin *et al.* (2002), utilising naturally occurring cases of DDSP, which are endoscoped at racing speeds (treadmill or overground endoscopy) both with and without TTs in place using a randomised crossover study design, will ultimately provide evidence to support or refute the physical effects of TT use on the upper airway of DDSP-afflicted horses. Additionally, the potential psychological effects of TT use on horses (and jockeys!) may be significant but are difficult to either prove or quantify.

It should be noted that while TT use appears to enhance performance of selected horses with a perceived soft palate or behavioural (bitting) problem, the results of this study should not be interpreted as promoting TT use for normal racehorses as a performance enhancing aid.

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References

- Barakzai, S.Z. and Dixon, P.M. (2005) Conservative treatment for racehorses affected with intermittent dorsal displacement of the soft palate. *Vet. Rec.* **157**, 337-341.
- Barakzai, S.Z., Finnegan, C., Dixon, P.M., Hillyer, M.H. and Boden, L.A. (2009a) Use of tongue ties in thoroughbred racehorses in the United Kingdom, and its association with surgery for dorsal displacement of the soft palate. *Vet. Rec.* **165**, 278-281.
- Barakzai, S.Z., Boden, L.A., Hillyer, M.H., Marlin, D.J. and Dixon, P.M. (2009b) Efficacy of thermal cautery for intermittent dorsal displacement of the soft palate as compared to conservatively treated horses: results for 78 treadmill diagnosed horses. *Equine vet. J.* **41**, 65-69.
- Beard, W.L., Holcombe, S.J. and Hinchcliff, K.W. (2001) Effect of a tongue-tie on upper airway mechanics during exercise following sternothyroid myectomy in clinically normal horses. *Am. J. vet. Res.* **62**, 779-782.
- Cornelisse, C.J., Rosenstein, D.S., Holcombe, S.J. and Derksen, F.J. (2001a) A computed tomographic study of the effect of a tongue-tie on hyoid apparatus position and nasopharyngeal dimensions in anaesthetised horses. *Am. J. vet. Res.* **62**, 1865-1869.
- Cornelisse, C.J., Holcombe, S.J., Derksen, F.J., Berney, C. and Jackson, C.A. (2001b) Effect of a tongue tie on upper airway mechanics in horses during exercise. *Am. J. vet. Res.* **62**, 775-778.
- Franklin, S.H., Naylor, R.R.J. and Lane, J.G. (2002) The effect of a tongue-tie in horses with dorsal displacement of the soft palate. *Equine vet. J., Suppl.* **34**, 430-433.

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