New Dental Anomalies in the Greater Japanese Shrew Mole Urotrichus talpoides (Eulipotyphla: Talpidae)

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Original paper

New dental anomalies in the greater Japanese shrew mole *Urotrichus talpoides* (Eulipotyphla: Talpidae)

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Abstract. Dental anomalies in the greater Japanese shrew mole *Urotrichus talpoides* Temminck, 1841 (Eulipotyphla: Talpidae) were examined, based on 1001 specimens. We followed the dental formula of *U. talpoides* I 2/1, C 1/1, P 4/3, M 3/3 = 36, which is adopted by the most recent Japanese researchers, and found dental anomalies in 17 specimens involving 12 instances of absent tooth, four of extra tooth, and one of connate tooth. Of these, the following dental anomalies are reported in *U. talpoides* for the first time: extra tooth posterior to the upper canine (C^1), extra tooth posterior to the upper second premolar (P^2), extra teeth on the inner sides of the upper fourth premolars (P^4), and connate tooth on the lower canine (C_1). The most frequently observed dental anomaly was the absent tooth on C^1 (52.9%), whereas the others were not common (< 11.8%). Our results indicate that dental anomalies in *U. talpoides* in Urotrichini possess the different pattern from those in species in Scalopini and Talpini. On the other hand, alternative hypothesis of dental formula I 3/2, C 1/1, P 3/2, M 3/3 = 36 explains the observed anomaly pattern in line with the general trend of dental anomalies in Talpini and Scalopini.

Key words: absent tooth, connate tooth, dental formula, extra tooth, Urotrichini.

Dental anomalies have been known at low frequencies in representative species for most orders of mammals (Feldhamer et al. 2020) but reported as an exceptionally high occurrence in a few species of subfamily Talpinae, family Talpidae, order Eulipotyphla (Stein 1962; Kawada et al. 2006, 2011). Talpinae is therefore an interesting subfamily to study dental anomalies. The size and shape of each tooth have been differentiated among five tribes of Talpinae, reflecting the evolutionary process (Motokawa 2004). Dental characteristics of those five tribes in reference to the incisors and canines are as follows: in Talpini (*Euroscaptor*, *Mogera*, *Oreoscaptor*, *Parascaptor*, *Scaptochirus*, and *Talpa*), the incisors are small, but the upper canine (C^1) is significantly large; in Condylurini (*Condylura*), the upper second incisor (I^2) is larger than the upper first incisor (I^1), which exceeds the size of C^1; in Desmanini (*Desmana* and *Galemys*), I^1 is heavily large, while I^2, the upper third incisor (I^3), and C^1 are small; in Scalopini (*Scalopus*, *Scapanus*, *Parascalops*, and *Scapanulus*), I^1 is large and larger than C^1, and I^2 and I^3 are small; in subtribe Urotrichina of Urotrichini (*Dymecodon*, *Neurotrichus*, and *Urotrichus*), I^1 is large, I^2 is secondarily large, and C^1 is small; and in subtribe Scaptonychina of Urotrichini (*Scaptonyx*), I^1 is smaller than C^1 (Abe 2007; Kryštufek and Motokawa 2018).

In Talpini, Scalopini, and Urotrichini, dental anomalies have been reported, such as extra, absent, or connate teeth: 14 species in Talpini, four species in Scalopini, and two species in Urotrichini (Hall 1940; Miyao 1972; Imaizumi and Kubota 1978; Hoffmann 1984; Kawada et al. 2006; Feldhamer and Towery 2011; Kawada et al. 2011; Asahara et al. 2012; Sasaki 2016; Kryštufek and Motokawa 2018). An extra tooth is defined as an additional tooth with normal dentition possessing a crown

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with independent root as seen in surface observations; an absent tooth is defined as congenital and postnatal tooth loss, excluding tooth loss after birth with roots or alveoli remaining as seen in surface observations; and a connate tooth is two teeth sharing the same root (Miles and Grigson 1990; Kawada et al. 2006, 2011). In Condylurini, no dental anomalies were found in 14 specimens of *Condylura cristata*. In Desmanini, there has been no report regarding dental anomalies.

In Talpini, dental anomalies have been found primarily for premolars (97.1% of all dental anomalies as found in 739 examples), comprising absent (76.9%), connate (13.5%), and extra premolars (6.7%) (Kryštufek et al. 2001; Kawada et al. 2006, 2011; Asahara et al. 2012). In Scalopini, dental anomalies include absent premolars (73.8%) and absent incisors (24.6%) (Hall 1940; Feldhamer and Towery 2011). In Urotrichini, dental anomalies were reported in *Urotrichus talpoides*, as absent canines (7.7% in 246 individuals) and premolars (10.5%) (Miyao 1972), an extra tooth between C_1 and the lower second premolar (P_2) (0.36% in 1120 individuals) (Imaizumi and Kubota 1978; Sasaki 2016), and extra tooth in premolars (0.8% in 246 individuals) (Miyao 1972), as well as in *Dymecodon pilirostris* as absent canines and premolars (Miyao 1972).

These dental anomalies in Talpinae have been mostly reported for incisors or premolars, while fewer examples have been known for canines or molars (Hall 1940; Hoffmann 1984; Kawada et al. 2006, 2011; Feldhamer and Towery 2011; Asahara et al. 2012). Canine dental anomalies in Talpinae have been reported only in four species—one case of extra upper canine in *Mogera wogura* (Kawada et al. 2011), one case of an absent upper canine in *Scapanus latimanus* (Hall 1940), 17 cases of absent upper canine and two cases of absent lower canine in *U. talpoides* (Miyao 1972), and two cases of absent upper canine in *D. pilirostris* (Miyao 1972). In terms of molar dental anomalies, ten cases of an extra tooth distal to the third upper molar and an extra tooth distal to the third lower molar have been reported only in *Talpa altaica* (Kawada et al. 2006).

Urotrichus talpoides in Urotrichini is an interesting species within Talpinae involving high occurrence of absent canine among 246 specimens (Miyao 1972). On the other hand, no case of dental anomaly in canine has been found in the following studies that examined 1120 specimens of the species (Imaizumi and Kubota 1978; Sasaki 2016).

Herein, the frequent occurrence of C^1 dental anomaly is the characteristics of the dental anomaly of *U. talpoides*. In addition, it should be noted that the position of C^1 is different between two different hypotheses of dental formula for *U. talpoides*: I 2/1, C 1/1, P 4/3, M 3/3 = 36 including ante-molars I^1, I^2, C^1, P^1, P^2, P^3, P^4/I_2, C_1, P_2, P_3, P_4, was proposed by Imaizumi and Kubota (1978); while I 3/2, C 1/1, P 3/2, M 3/3 = 36 including ante-molars I^1, I^2, I^3, C^1, P^1, P^3, P^4 / I_2, I_3, P_1, P_3, P_4, was proposed by Ziegler (1971). Imaizumi and Kubota (1978) regarded the fifth tooth before M^1 as C^1, based on the definition that C^1 appears at sutura incisiva; while fourth tooth before M^1 is C^1 following Ziegler (1971). Though the dental formula of Imaizumi and Kubota (1978) has been widely accepted, Kawada et al. (2001) reconsidered the tooth formula of *Desmana moschata* and revealed that C^1 position would not be detected by surface position of sutura incisiva and implied that I 3/2, C 1/1, P 3/2, M 3/3 = 36 (same as Ziegler 1971) might be suitable for *U. talpoides*. Herein, we conducted a comprehensive study of dental anomalies in *U. talpoides* based on 1001 specimens and discussed their significance in reference to dental formulae within Talpinae.

Materials and methods

We examined 1001 skulls of adult *U. talpoides* collected from a wide range of its distribution in Honshu, Kyushu, Shikoku, Tsushima Island, and Oki Islands in Japan. Specimens are stored at the Botanical Garden, Field Science Center for Northern Biosphere of Hokkaido University, Sapporo (HUNHM); the Kyoto University Museum, Kyoto University, Kyoto (KUZ); the National Museum of Nature and Science, Tsukuba (NSMT); and the private collection of Akio Shinohara (SAS; HEG).

We followed the dental formula proposed by Imaizumi and Kubota (1978): (I^1, I^2, C^1, P^1, P^2, P^3, P^4, M^1, M^2, M^3/I_2, C_1, P_2, P_3, P_4, M_1, M_2, M_3 = 36). This dental formula was initially mentioned in a brief report of Imaizumi (1949) without a detailed description and had been referred to in later literatures (Imaizumi 1960; Imaizumi and Obara 1966). After the formal description of this dental formula by Imaizumi and Kubota (1978), it is well accepted until recently (Sasaki 2016). We conducted surface observations of the upper and lower dentitions (Fig. 1) under a microscope and identified three types of dental anomalies, i.e., the absent, extra, and connate teeth. We excluded obvious postnatal tooth loss, whereby teeth roots or alveoli remained on the surface of the jaws as observed following the procedure of Kawada et al. (2011).

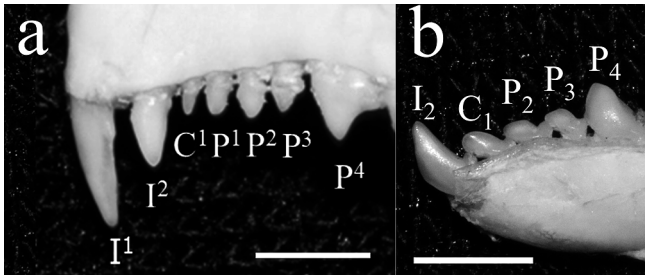

Fig. 1. Normal dentition of ante-molars in *Urotrichus talpoides* according to the dental formula proposed by Imaizumi and Kubota (1978). The upper first incisor (I^1) to the upper fourth premolar (P^4) (a; KUZ M7104), and the lower second incisor (I_2) to the lower fourth premolar (P_4) (b; KUZ M582). The scale bar represents 2 mm.

Results

Seventeen cases (1.7%) of dental anomalies were found in 1001 specimens examined. A single kind of anomaly was found in each individual with a dental anomaly. Of these, 12 specimens (70.6% of all anomalous specimens) had the absent tooth, four specimens (23.5%) had the extra tooth, and one specimen (5.9%) had the connate tooth (Table 1). These dental anomalies were associated with the canines or premolars in the upper and lower dentitions.

The absent tooth of C^1 was found in nine specimens (NSMT M19695, NSMT M7561, NSMT M23436, KUZ M7145, KUZ M7146 [Fig. 2a], HUNHM 53084, HUNHM 52572, HUNHM 53118, and HUNHM 50716)—presented bilaterally in six specimens and unilaterally in three specimens. The absent tooth of P^1 was detected in two specimens (HUNHM 53130 [Fig. 2b], HUNHM 50717)—presented unilaterally in both specimens. The absent tooth of P^2 was found in one specimen (HUNHM 50715 [Fig. 2c])— presented bilaterally (Fig. 2). Rearrangement of the positions of the teeth was observed in the cases involving the absent tooth. In cases of absent C^1 dentition, the small teeth posterior to C^1 (P^1, P^2, and P^3) were located moderately anterior to make the space corresponding to the absent tooth smaller; in cases of absent P^1 dentition, C^1 was located posteriorly and P^2 was transferred anteriorly; and in a case of absent P^2, P^1 was located posteriorly.

Unilateral extra tooth posterior either to C^1 or to P^2 was found in one specimen each (NSMT M5319 [Fig. 3a] and KUZ M7282 [Fig. 3b], respectively). Extra teeth were also found on the inner side of P^4 in one specimen (HUNHM 52235 [Fig. 3c]) and presented bilaterally. Another extra tooth on the lower jaw was found posterior to C_1 in one specimen (KUZ M748 [Fig. 3d]) and

Table 1. Number of specimens with absent, extra, and connate teeth observed in *Urotrichus talpoides*

		Anomaly tooth				
Dental anomaly	*n*	C^1	P^1	P^2	P^4	C_1
Absent teeth	12	9 (6 bilateral, 1 right, 2 left)	2 (2 left)	1 (1 bilateral)	–	–
Extra teeth	4	1 (1 right)	–	1 (1 left)	1 (1 bilateral)	1 (1 left)
Connation	1	–	–	–	–	1 (1 left)
Total	17	10	2	2	1	2

C^1: the upper canine, P^1: the upper first premolar, P^2: the upper second premolar, P^4: the upper fourth premolar, and C_1: the lower canine

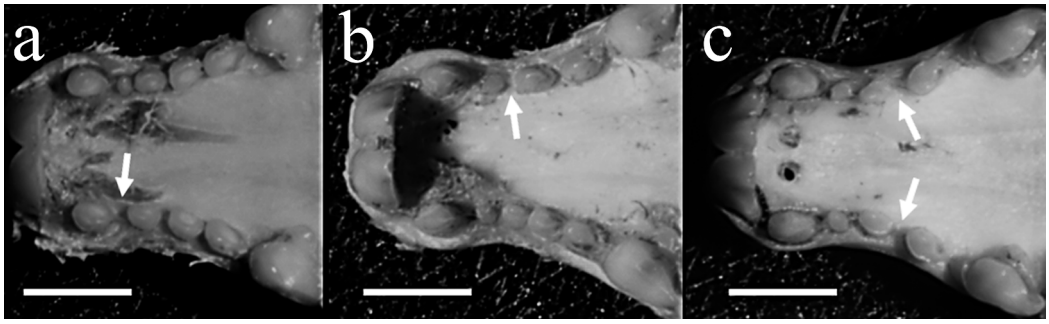

Fig. 2. Three cases of absent teeth (arrows) in *Urotrichus talpoides*. Absent tooth of the upper canine (C^1) on the right side (a; KUZ M7146), absent tooth of the upper first premolar (P^1) on the left side (b; HUNHM 53130), absent teeth of the upper second premolar (P^2) on the right and left sides (c; HUNHM 50715). The scale bar represents 2 mm.

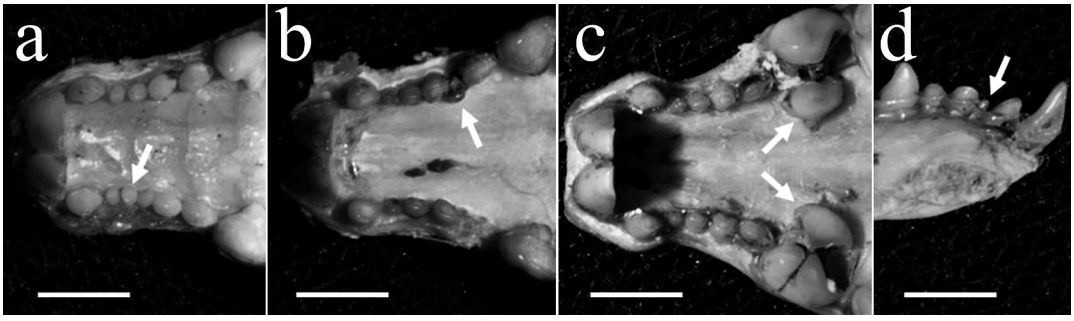

Fig. 3. Four cases of extra teeth (arrows) in *Urotrichus talpoides*. An extra tooth posterior to the upper canine (C^1) on the right side (a; NSMT M5319), an extra tooth posterior to the upper second premolar (P^2) on the left side (b; KUZ M7282), extra teeth on the lingual side of the upper fourth premolar (P^4) on the right and left sides (c; HUNHM 52235), and an extra tooth posterior to the lower canine (C_1) on the left side (d; KUZ M748). The scale bar represents 2 mm.

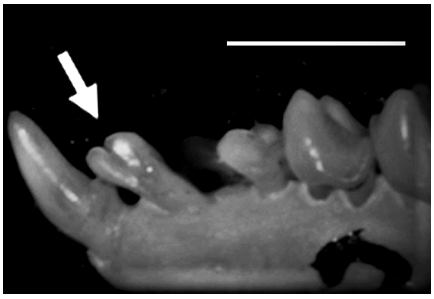

Fig. 4. A case of a connate tooth (arrow) on the lower canine (C_1) in left side in *Urotrichus talpoides* (NSMT M26663). The space posterior to the connate tooth was caused by a broken premolar tooth. The scale bar represents 2 mm.

presented unilaterally (Fig. 3). These extra teeth located posterior to C^1, P^2, or C_1 were slender teeth with a tiny single cusp, whereas the extra teeth located on the inner side of P^4 had a well-developed triangular crown with the length two-thirds of P^4 (Fig. 3c).

A connate tooth on C_1 was found in one specimen (NSMT M26663) and presented unilaterally (Fig. 4). Although the normal C_1 is a small unicuspid tooth (Fig. 1), the connate C_1 had a slightly bulging and two-lobed crown, sharing the same neck and root of the tooth (Fig. 4).

Discussion

The frequency of all dental anomalies in *U. talpoides* was 1.7% based on 1001 specimens in the present study, and it is low among talpine species: Talpini, 22.9% in *T. altaica* (n = 1789), 17.5% in *M. tokudae* (n = 57), 9.9% in *M. robusta* (n = 241), 6.4% in *M. wogura* (n = 687), 1.8% in *M. imaizumii* (n = 331) (Kawada et al. 2006, 2011; Asahara et al. 2012); Scalopini, 14.5% in *Scalopus aquaticus* (n = 249), 8.7% in *S. latimanus* (n = 265), and 1.2% in *S. orarius* (n = 81) (Hall 1940; Feldhamer and Towery 2011); Urotrichini, 20.4% in *D. pilirostris* (n = 54) (Miyao 1972). Such lower occurrence of the dental anomaly in *U. talpoides* coincides with 0.36% in the previous studies (n = 1120; Imaizumi and Kubota 1978; Sasaki 2016). In contrast, the higher frequency (15.0%) in *U. talpoides* (n = 246) was reported by Miyao (1972). The reason responsible for such differences is uncertain.

In the present study, three kinds of dental anomalies were detected at four different tooth positions in *U. talpoides*. Extra teeth posterior to C^1, posterior to P^2, or posterior to P^4 (Fig. 3) and a connate tooth on C_1 (Fig. 4) were reported for the first time. The remaining dental anomalies of a small single cusped extra tooth posterior to C_1 (Imaizumi and Kubota 1978; Sasaki 2016) and absent C^1, P^1, P^2 (Miyao 1972) have been reported previously.

All the absent teeth in *U. talpoides* represented the small teeth, C^1, P^1, and P^2. For these small haplodont teeth of *U. talpoides*, the conical C^1 is slightly smaller than the cone-shaped P^1, and teeth sizes increase to be $C^1 < P^1 < P^2$ (Fig. 1). In contrast to teeth size, the frequency of absent teeth was observed as $C^1 > P^1 > P^2$ (Table 1), which indicates that smaller teeth are more likely to be absent.

The extra tooth posterior to C^1 and the extra tooth posterior to C_1 were small conical teeth. The extra tooth posterior to C_1 was considered as a result of atavistic event of the lower first premolar (P_1) which had been lost in the evolutionary process of Urotrichini (Imaizumi and Kubota 1978; Sasaki 2016). However, it is difficult to conceive that the tooth reverted to P_1 according to the law of irreversibility (Gould 1970). The morphology of the extra tooth was too diminutive and thin to be recognized as P_1. The extra tooth posterior to P^2 was chisel-shaped (Fig. 5), similar to the extra premolars in *T. altaica* and *M. robusta* in Talpini (Kawada et al. 2006; Asahara et al.

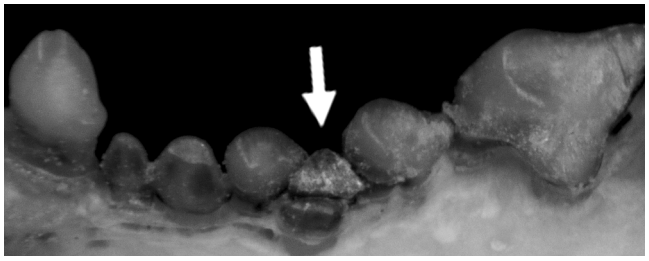

Fig. 5. A chisel-shaped extra tooth between P^2 and P^3 in left side in *Urotrichus talpoides* (KUZ M7282).

2012). The extra tooth located at the inner position of P^4 had a unique morphology—a well-developed triangular crown—but was slightly smaller than P^4. The deciduous P^4 of *U. talpoides* also has a well-developed triangular crown and is smaller than a permanent P^4 (personal observation), similar to this extra P^4. This extra P^4 might be a persistent deciduous tooth, similar example to the extra tooth on the buccal side of P^4 in *T. altaica* in Talpini (Kawada et al. 2006).

The connate tooth has been reported in mandibular premolars in *T. altaica* and *M. wogura* in Talpini (Kawada et al. 2006, 2011). However, the connate tooth of *U. talpoides* in the present study was C_1, and this is the first report of a connate C_1 in Talpinae.

The dental anomalies in *U. talpoides* involved canine and premolars but did not involve incisors. Dental anomalies in Talpinae have been reported to involve incisors, canine, and premolars (Hall 1940; Hoffmann 1984; Kryštufek et al. 2001; Kawada et al. 2006; Feldhamer and Towery 2011; Kawada et al. 2011; the present study). Interestingly, dental anomalies occur in the incisor row in both Scalopini and Talpini, but not in Urotrichini. Canine dental anomalies are few in Talpini and Scalopini, and only an example of extra canine in *M. wogura* (Kawada et al. 2011) in Talpini and an absent canine in *S. latimanus* (Hall 1940) in Scalopini have been reported. Canine anomalies in Urotrichini, on the contrary, involve extra, absent, and connate teeth in the upper and lower dentitions of *U. talpoides* in the present study.

Such differences in canine anomalies between *U. talpoides* and species in Scalopini or Talpini may be related to the size and arrangement of the teeth: *U. talpoides* has short, thin, weak, and small canine (Fig. 1) (Imaizumi and Kubota 1978), whereas Scalopini and Talpini have large canine (Kryštufek and Motokawa 2018). As dental anomalies usually involve small teeth with less functionality (Hall 1940), the small and less functional canine of *U. talpoides* may be subject to frequent dental anomalies.

Two different dental formulae should also be reconsidered for *U. talpoides* to understand the differences between Urotrichini and Scalopini / Talpini. We followed the formula I 2/1, C 1/1, P 4/3, M 3/3 = 36, which includes ante-molars as follows: I^1, I^2, C^1, P^1, P^2, P^3, P^4/I_2, C_1, P_2, P_3, P_4, with a diphyodont P^1 and a monophyodont P^2, based on the sutura incisiva as an indicator of the canine position (Imaizumi and Kubota 1978). In contrast, another dental formula I 3/2, C 1/1, P 3/2, M 3/3 = 36, which includes ante-molars as follows: I^1, I^2, I^3, C^1, P^1, P^3, P^4 / I_2, I_3, P_1, P_3, P_4, with a monophyodont P^1, was described by Ziegler (1971) based on the first premolar position.

The most common dental anomaly involved C^1 in the present study following the dental formula of Imaizumi and Kubota (1978), but this tooth could be alternatively regarded as I^3 when adopting the dental formula of Ziegler (1971). Indeed, it is unclear whether observations of the sutura incisiva only from the cranium surface is a reliable indicator of the canine position, as Kawada et al. (2001) revealed that the position of sutura incisiva was inconsistent with the position of the canine in *D. moschata* in Desmanini. Furthermore, following the dental formula of Imaizumi and Kubota (1978), *U. talpoides* should be an exceptional species among living placentals that possesses a diphyodont P^1, instead of monophyodont P^1.

Here, the most frequently observed dental anomaly of *U. talpoides* involved I^3 if we adopt the alternative dental formula of Ziegler (1971). Accordingly, the high occurrence of I^3 dental anomalies is shared among Urotrichini, Scalopini, and Talpini, while frequency of a canine dental anomaly turns to be low—two absent C^1 in *U. talpoides* in Urotrichini (Table 2) as well as an extra canine in *M. wogura* in Talpini (Kawada et al. 2011) and an absent canine in *S. latimanus* in Scalopini (Hall 1940). The most frequent dental anomaly at the I^3 position in *U. talpoides* may be explained by the terminal reduction and addition theory (Koyasu 1993), which hypothesized that tooth reduction or addition occurred in the anterior or posterior regions of incisors, premolars, or molars. As well, it is convincing that "a diphyodont P^1" in *U. talpoides* corresponds to a diphyodont C^1, and P^1 become monophyodont as in Scalopini, Talpini and most placentals (Hall 1940; Hoffmann 1984; Kawada et al. 2006; Feldhamer and Towery 2011; Kawada et al. 2011; Asahara et al. 2012). Our results suggested that more stable and appropriate dental formula would be that proposed by Ziegler (1971), and we recommend adopting this dental formula for *U. talpoides*.

Table 2. Comparison of number of dental anomalies at each dental position in ante-molars of *Urotrichus talpoides* in following two different dental formulae of Imaizumi and Kubota (1978) and Ziegler (1971)

Dental formula	Dental anomalies															
	Upper dentition								Lower dentition							
	I^1	I^2	I^3	C^1	P^1	P^2	P^3	P^4	I_1	I_2	I_3	C_1	P_1	P_2	P_3	P_4
Imaizumi and Kubota (1978)	0	0	–	10	2	2	0	1	–	0	–	2	–	0	0	0
Ziegler (1971)	0	0	10	2	2	–	0	1	–	0	2	–	0	–	0	0

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Appendix 1.

List of the specimens examined in the present study, which have been stored in Botanic Garden, Field Science Center for Northern Biosphere in Hokkaido University, Sapporo (HUNHM); The Kyoto University Museum, Kyoto University, Kyoto (KUZ); National Museum of Nature and Science, Tsukuba (NSMT); and private collection of Akio Shinohara (SAS; HEG).

HUNHM 50715–50179, 50885, 50886, 50888–50891, 50895, 52084, 52085, 52095, 52226–52239, 52556–52567, 52569–52575, 52577, 52578, 52588, 52589, 52591, 52593–52595, 52597–52615, 52620, 52624, 52625, 52627, 52628, 52630–52637, 52639, 52640, 52643–52649, 52654–52657, 52659–52661, 52665, 52666, 52670, 52673–52678, 52681, 52682, 52685–52700, 53056–53059, 53061–53141, 53143–53153, 53155–53164, 53321–53324, 53327–53332, 53335–53338, 55257, 55793, 55794, 55897–55902, 55904–55906, 55945, 55946, 56070, 56093, 56119, 56175, 57688–57690, 57738, 57794–57844, 58362, 58363.

KUZ M071, M072, M117, M155, M200, M216, M217, M227, M236–M238, M288, M297–M309, M324, M336, M466–M468, M582, M583, M588, M590, M631, M634, M671, M709, M711, M716, M717, M726, M727, M729, M732, M733, M736–M739, M745, M747–M750, M838, M1021, M1289, M1302, M1329, M1507, M4430, M7099–M7106, M7111, M7113–M7137, M7139–M7174, M7176–M7200, M7202–M7210, M7212, M7213, M7215–M7223, M7225–M7230, M7232–M7250, M7252–M7284, M7286–M7298, M7300–M7305.

NSMT M1413, M1430, M1468, M1469, M1726, M2334, M2411, M2412, M2420, M2735, M2741, M2742, M2753, M2850, M2851, M2879, M2974, M2976, M2993, M2995, M3149–M3153, M3261, M3304, M3305, M3345, M3347, M3348, M3370, M3391, M3400, M3421, M3424–M3426, M3499, M3600, M3602, M3651, M3657, M3757, M3830–M3835, M3837, M3838, M3851–M3856, M3873, M3874, M3947, M3948, M4001, M4002, M4270, M4271, M4290, M4291, M4324, M4474, M4477, M4530–M4533, M4535b, M4537, M4541, M4542, M4577, M4578, M4673, M4674, M4748, M4928, M4929, M4943–M4945, M5070, M5071, M5091, M5113, M5128, M5154–M5156, M5204, M5205, M5314, M5316, M5319, M5326, M5327b, M5402–M5405, M5805, M6475, M7561, M7781, M7833, M8796–M8798, M8901, M8902, M8923, M8924, M8966, M8987, M9095, M9110, M9112, M9213, M9433, M9528, M9589, M9630, M9633, M9635, M9637, M9658, M9790, M9795–M9797, M9799, M9800, M9807, M9812–M9819, M9822, M9823, M9825, M9834, M9895, M9896, M9901, M9902, M9910, M10022, M10402, M10404, M10441, M10442, M10483, M10484, M10499–M10501, M10630, M11235, M11238, M11248, M11249, M11503, M11504, M11552–M11554, M11571, M11572, M11574, M11582, M11826, M12240, M12606, M12734, M12738, M12763, M12764, M12767, M12768, M12770, M12786, M12788, M13718, M13800, M13918, M13920, M14513, M14514, M14516, M16039, M16177, M16872, M16905, M16910–M16912, M16916, M16919, M17013, M17070, M17334, M17335, M17337, M17509, M17545, M17577, M17578, M17649, M17651, M17652, M17675–M17680, M17695–M17699, M17772–M17778, M17940, M19693–M19696, M19969, M20123, M20125, M20560, M20561, M20690, M21201, M21436, M21437, M21440–M21447, M21449, M21451–M21458, M21461–M21467, M21570, M21571, M23420, M23421, M23424–M23430, M23432, M23434–M23436, M23438, M23440, M23441, M23443, M23444, M23448, M23450–M23452, M23454, M23456, M23458–M23460, M23464, M23466–M23470, M23500, M23587, M23588, M25710, M25712–M25715, M26661–M26663, M26827, M27189–M27193, M27330, M27334–M27337, M27471, M27886, M28201–M28204, M28206, M28207, M28684, M28685, M28745, M28746, M29115, M29117, M29443, M29455–M29457, M33927.

SAS 1, 25–28, 31–38, 40–42, 46, 65, 67, 70.

HEG 84-97, 85-97, 95-97, 127-98, 132-98, 231-98, 233-98, 234-98, 235-98, 236-98, 237-98, 238-98, 239-98, 241-98, 242-98, 243-98, 244-98, 245-98, 248-98, 249-98, 250-98, 252-98, 253-98, 254-98, 255-98, 256-98, 257-98, 258-98, 259-98, 261-98, 262-98, 263-98, 264-98, 266-98, 267-98, 268-98, 270-98, 271-98, 272-98, 277-98, 278-98, 279-98, 282-98, 283-98, 284-98, 285-98, 287-98.