Fourth Molars in the Anthropoidea

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ABSTRACT Fourth molars are not common in the anthropoidea. Orangutans possess the highest frequencies (7-13%) while many genera in the suborder lack the fourth molars. A review of the incidence of M4’s in the Anthropoidea is presented and a description of the ontogeny of M4 in Macaca nemestrina is described and offered as an explanation of the development of M4’s in this taxon.

MATERIALS AND METHODS

The parental generation was collected from free-ranging populations in Sumatra and transported to the National Primate Research Center at the University of Washington. These animals were the breeding colony of the animals in the longitudinal growth and development study (Sirianni and Swindler, 1985). After weaning, between 3 and 8 months, the animals were raised and housed separately with their age mates. Radiographs of the head in norma lateralis were taken on a regular schedule from about three months to seven years. There were a total of 140 animals in the study, 70 females and 70 males. Tables 1, 2 and 3 present the number of specimens with M4’s except for the figures presented of Selenka (1898), Hrdlička (1907) and Hooijer (1948) in Table 2 that record the total number of M4’s.

RESULTS AND DISCUSSION

The M4 was observed in the radiograph of one male and was present in both the maxilla and mandible. Thus of a total sample of 140 Macaca nemestrina 0.7% showed this condition (Table 1). A slightly lower percentage has been reported for the presence of M4 for the genus Macaca by Miles and Grigson, 0.2% of 901 animals (1990), Lavelle and Moore (1973) recorded 0.3% for 350 Macaca

### TABLE 1. Incidence of M4’s in the Cercopithecidae

| Genus            | Number of Specimens | M4 | Percent |
|------------------|---------------------|----|---------|
| Colobus          | 1,485               | 22 | 4.00    |
| Colobus          | 140                 | 0  | 0.00    |
| Colobus          | 155                 | 5  | 3.23    |
| Presbytis*       | 289                 | 1  | 0.30    |
| Presbytis*       | 100                 | 0  | 0.00    |
| Presbytis*       | 321                 | 1  | 0.31    |
| Pygathrix*       | 16                  | 0  | 0.00    |
| Rhinopithecus*   | 17                  | 0  | 0.00    |
| Rhinopithecus*   | 11                  | 1  | 9.10    |
| Simias*          | 10                  | 0  | 0.00    |
| Nasalis*         | 83                  | 0  | 0.00    |
| Cercopithecus*   | 1,823               | 10 | 0.50    |
| Cercopithecus*   | 350                 | 4  | 1.10    |
| Cercopithecus*   | 2,460               | 16 | 0.65    |
| Erythropsithecus*| 95                  | 3  | 3.20    |
| Erythropsithecus*| 95                  | 2  | 2.11    |
| Cercrobus*       | 311                 | 0  | 0.00    |
| Papio*           | 410                 | 2  | 0.50    |
| Papio*           | 38                  | 1  | 2.60    |
| Papio*           | 541                 | 6  | 1.11    |
| Mandrillus*      | 56                  | 0  | 0.00    |
| Theropithecus*   | 7                   | 0  | 0.00    |
| Macaca*          | 901                 | 2  | 0.20    |
| Macaca*          | 140                 | 1  | 0.70    |
| Macaca*          | 350                 | 1  | 0.30    |
| Macaca*          | 2,379               | 9  | 0.38    |

1Miles and Grigson (1990) (M4 and M4)
2Lavelle and Moore (1973) (M4 and M4)
3Hooijer(1952) (M4)
4This paper (M4 and M4)
5Krapp and Lampel (1973) (M4 and M4)
6P. entellus and vetulus groups

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FOURTH MOLARS

as having total polygenesis but did not designate which teeth were involved. Krapp and Lampel (1973), in their comprehensive study of dental anomalies of living anthropoidea, found 0.38% of 2,379 macaque specimens with fourth molars.

The presence of extra teeth is low in all living cercopithecids irrespective of the tooth group, and it is interesting to note that most investigations have found a higher incidence of M4’s in the subfamily Cercopithecinae than in the Colobinae, (Table 1). A notable exception to this finding is the 9.1% presence in Rhinopithecus; however, that figure represents one specimen out of a total of only eleven animals (Table 1). Of all the genera depicted in Tables 1, 2 and 3, Pongo has the highest frequency of M4 while colobines and New World monkeys generally have the lowest frequencies. Among living primates, Pongo is generally reported to have the highest percentage of M4’s (Tables 1, 2 and 3). Gibbons appear to lack development of M4, a fact that has been known since the work of Bateson (1894) as reported in Miles and Grigson (1990). Also, several different genera of both New and Old World monkeys lack the occurrence of M4. The taxonomic presence of M4’s in the living Anthropoidea seems to lack any discernible correlation with body mass or facial prognathism since the M4 condition appears in primates ranging in size from gorillas to squirrel monkeys and in primates with both long and short snouts.

The aetiology of polydontia is uncertain. Earlier literature suggested that such occurrences were the result of atavism, although today the term has lost favor in most scientific circles. The heritability of the condition is not completely understood (Finn, 1967); however, there is evidence indicating that polydontia appears more often in isolated populations, and especially among some domesticates, which has suggested the involvement of genetic drift as a possible cause to Miles and Grigson (1990).

“Connate teeth” is an anomaly; that is, double teeth, incomplete dichotomy, or syndonty that should be reserved for teeth that are “developed or born together” (Miles and Grigson, 1990; Winkler and Swindler, 1993; Drusini and Swindler, 1994).

In the present case, both the upper and lower M4 would seem to represent the continued distal growth of the dental lamina in that M4 appears distally to the formation of M3. The development of M4 will be discussed since it is more easily observed and it is assumed that M4 passed through similar developmental stages. The dental follicle and M4 appear between 5.5 and 6.2 years. At 6.2 years the crown is present, the cusps are connected but the crown is not complete and it is inclined obliquely at about 45° to the occlusal plane (Fig. 1). There is no root development and the cleft has not yet formed, and as seen in this radiograph, an interdental septum separates M4 from M3 (Fig.1). In Fig. 2, (7.0 years), the crown appears nearly formed with beginning root formation while the crown is still inclined relative to the occlusal plane. The mesiodistal length of the crown is 8.5 mm which is about 3 mm shorter that the average size of M3 in male M. nemestrina (10.9 mm) and about equal in length to M2 (8.6 mm) (Swindler, 2002). Thus, this M4 is within the normal mesiodistal size range for molars of M. nemestrina. Unfortunately, this animal was not studied after 7 years of age so there is no information regarding the age of the animal when M4 emerged.

CONCLUSION

The presence of M4’s is rare among living primates, particularly in gibbons, New World monkeys and colobine genera. The orangutans possess the highest frequency of M4’s (7 to 13%) of all living anthropoidea. The aetiology of M4’s remains uncertain and may represent different developmental processes in different
On the basis of the present specimen, it seems clear that M₄ develops in a normal manner i.e., follicle, initial calcification, crown formation and root formation from a distal extension of the dental lamina, and that tooth formation takes place in a follicle distal to an interdental septum between it and M₃.

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