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# Regional Occurrence of the Fern-Root Plane in Prehistoric New Zealanders

A. I. F. Simpson

Anatomy Department,  
Otago University Medical School,  
Dunedin

## ABSTRACT

The fern-root attritional plane has been used as an indication of the regular chewing of dried sticks of fern-root (rhizome of bracken, *Pteridium aquilinum* var. *esculentum*) in prehistoric New Zealand. The frequency of occurrence of this dental phenomenon is considered by geographical region in the prehistoric Maori and Moriori, from a sample of 81 dentitions. The fern-root plane was found regularly only in dentitions from Northland and the Chatham Islands, 66% and 78% respectively having fern-root planes. It was totally absent in the southern North Island. There is a clear association between the fern-root plane and interproximal dislocation, and this is interpreted as indicating a common causation of these two dental phenomena. The nature of the external force causing the phenomenon is discussed.

**Keywords:** FERN-ROOT PLANE, TOOTH DISLOCATION, DENTITION, MAORI AND MORIORI, PREHISTORIC, GEOGRAPHICAL DISTRIBUTION.

## INTRODUCTION

Taylor (1963) first fully described the presence of a distinctive form of tooth wear on prehistoric Maori and Moriori teeth. He found planes of wear on molar and premolar teeth which were "irregularly convex in general occluso-buccal direction so that when the jaws are closed the occlusal surfaces do not fit and the separation is greater on the buccal surface" (Taylor 1963:117). It differs from the usual molar wear plane, the helicoidal plane, in that the wear facet or plane lies in a position beyond that which can have been caused by another tooth. It resulted, according to Taylor's hypothesis, from feeding a stick of dried *Pteridium aquilinum* var. *esculentum* rhizome across the molar and premolar teeth in a bucco-lingual direction as described by Buck (1925). This action and the subsequent rechewing of the fibrous bolus could, according to Taylor, be expected to result in non-occlusal attrition, and he proposed that such wear was direct evidence of fern-root consumption. The term "fern-root plane" was then coined for such non-occlusal wear.

Lingual dislocation of the tooth crown about its interproximal axis was also observed by Taylor (1963) and by the earlier workers Scott (1893) and Pickerill (1912). Such dislocation was seen by Taylor both in association with the fern-root plane and occurring alone, and was held by both Scott and Taylor to be the result of some external force acting in a bucco-lingual direction. Such dislocation is found only in the molar and, less commonly, premolar regions. Buck (1925) pointed out that the method of chewing fern-root places lateral strain on these teeth in the manner required. Fern-root chewing by these people has therefore been held responsible for two dental features: non-occlusal attrition and tooth dislocation. This paper considers these two features in terms of their geographical distribution in prehistoric New Zealand and the Chatham Islands.

## MATERIALS AND METHODS

The sample consists of 81 prehistoric adult dentitions from New Zealand and the Chatham Islands. The material is housed in the War Memorial Museum, Auckland; National Museum, Wellington; Canterbury Museum, Christchurch; Otago Museum, and the Anatomy Department Museum of the University of Otago Medical School, Dunedin; and was studied as part of a larger study of health assessment in prehistoric New Zealand (Simpson 1979). Although geographical provenance was always known,

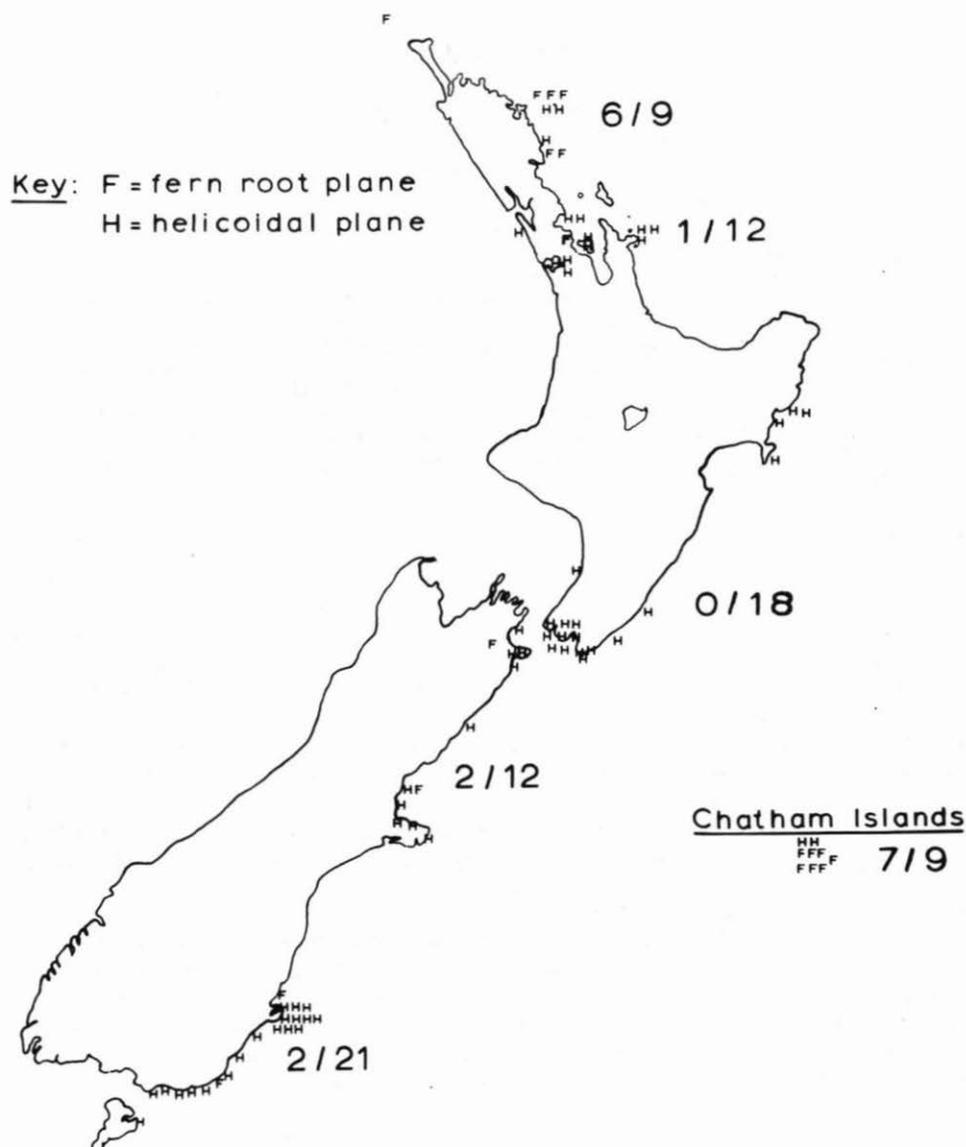


Figure 1: Regional occurrence of fern-root wear plane and helicoidal wear plane in prehistoric New Zealand. The first of the two figures for each region is the number of individuals showing a fern-root plane, while the second figure is the total number of individuals studied from that region.

temporal or cultural connections were usually scant, with only a few being reliably associated with specific cultural material (individuals from Palliser Bay, Wairau Bar and Waihora, Chatham Islands). For this reason geographical differences only were sought and temporal considerations ignored. All material derives from coastal regions and, due to the random nature of much of its recovery, the probability is that the sample is mainly from the latter portion of the prehistoric sequence. Eighty one dentitions is obviously a woefully small sample to be considered as representative of the dental state in prehistoric New Zealand. Large areas, such as the west coasts of both islands, have no representation. The only adequately recorded areas are Northland-Auckland, Wellington-Wairarapa, coastal Otago and the Chatham Islands (Fig. 1). Any conclusions must then apply essentially to these regions.

To be considered for this study, the dentition had to contain at least half of the molar and premolar teeth. Excessive ante or post-mortem loss would obviously give misleading results. The form of the molar attritional plane, whether helicoidal or "fern-root", was then assessed according to the criteria of Taylor (1963). The presence of any tooth dislocating about its interproximal axis was also noted. A fern-root plane on one tooth or a dislocating tooth anywhere in the jaw was sufficient for the dentition to be so assigned. A regional distribution of each feature was thus constructed.

## RESULTS

The regional frequencies of occurrence are presented in Tables 1 and 2 and Figure 1. Fern-root planes and interproximal dislocation were found most commonly at the first molar but also on the neighbouring teeth, particularly on the second molar and second premolar. Both features were confined to the cheek teeth. Only two regions displayed the fern-root plane with any regularity. These were the Chatham Islands, where seven of the nine dentitions were found to display this wear form, and the northern North Island, where the incidence was 7 out of 21. In this latter region, particular areas are of note. Whilst three out of five dentitions from the Cavalli Islands have fern-root planes, as well as a number of others from Northland, the frequency drops in the Auckland Isthmus-Coromandel area, where the wear form is predominantly helicoidal. In the southern North Island material, no fern-root planes were encountered. It is my view, contrary to that of Sutton (1978), that the dental remains from Palliser Bay show no fern-root planes, a conclusion more in line with the botanical evidence (Leach and Leach 1979:261). Only isolated examples of fern-root planes were seen in the South Island.

TABLE 1  
DISTRIBUTION OF HELICOIDAL AND FERN-ROOT PLANES

Region	Number showing helicoidal plane	Number showing fern-root plane	Percentage showing fern-root plane
Total population	63	18	22.2%
Northern North Island	14	7	33.3%
Southern North Island	18	0	0%
Northern South Island	10	2	16.7%
Southern South Island	19	2	9.5%
Chatham Islands	2	7	77.8%

The geographical distribution of lingual crown dislocation approximates closely that of the fern-root plane, with 15 of the examples of dislocation being from individuals with this non-occlusal attrition. The remaining seven cases were often associated with other individuals displaying fern-root planes. Such is the case with the Cavalli Islanders (four out of five show tooth dislocation, three show fern-root plane) and two individuals from North Canterbury (both have dislocating teeth and one shows a fern-root plane).

TABLE 2  
DISTRIBUTION OF INTERPROXIMAL DISLOCATION OF MOLAR AND PRE-MOLAR  
TEETH

Region	Number of individuals with at least one tooth dislocating	Total number	Percentage of individuals with tooth dislocation
Total population	23	80	28.7%
Northern North Island	8	21	38.1%
Southern North Island	2	18	11.1%
Northern South Island	4	12	33.3%
Southern South Island	2	21	9.5%
Chatham Islands	7	8	87.5%

One of the two Morioris who did not have a fern-root plane did have a dislocating first molar. Thus there does appear to be a geographical and individual coincidence of the two features.

## DISCUSSION

Tooth dislocation and resultant curved attritional surfaces were originally observed by Scott (1893) and considered by him to be a result of some external force being applied to the tooth. Buck (1925) proposed that this external force was a length of dried fern-root. He describes a 20–25cm length of the rhizome being pushed into the mouth across the first molars and a bolus of once-chewed fern-root then being held in the cheek and fed across the teeth until all the food matter was extracted.

Such chewing supplied both the external force required to explain the prevalent dislocation and also the high degree of attrition observed. Taylor (1963) took the matter a stage further by observing a further attritional feature — non-occlusal attrition on the cheek tooth's buccal aspect. Buck's account of fern-root consumption could also account for such attrition according to Taylor. The fact that in this study an individual displaying only one of the two features of dislocation or non-occlusal attrition was often in close regional and cultural association with others who show both of these features, lends support to a related causation for the two. Whether an individual will display a fern-root plane, interproximal dislocation, or both, may well come down to idiosyncratic differences in mastication. The connection between the two seems firm.

With this description of vigorous chewing of the fibrous fern-root bolus held in the cheek, the possibility arises that any fibrous mass so held could cause wear facets described as fern-root planes. Taylor (1963) considers the rhizome of *Cordyline terminalis* and dried fish or shellfish also to be possibilities, and Leach and Leach (1979) mention other species of fern. Similarly any solid item of food habitually pushed against the molars as described by Buck (1925) could cause lingual dislocation of the crown. However, the "shoving" in of the length of fern root as described by Buck (1925) appears the most likely source of lateral strain, and also, as Taylor (1963) explains, of non-occlusal attrition. Whatever the precise nature of the foodstuff, it was clearly tough, fibrous, and possibly gritty.

Dislocation of the teeth usually occurs in an initially healthy alveolus, though Pickerill's (1912) suggestion that alveolar abscesses tend to weaken lateral support of the root, and thus make the crown prone to swinging lingually during severe lateral stress of mastication, may account for some isolated cases of dislocation. The present study suggests that, of the broad regions, in only Northland and the Chatham Islands was fern-root regularly consumed in the manner described by Buck (1925). The importance of *Pteridium* rhizome in Northland has been stressed by Shawcross (1967) and in the Chatham Islands by Weiss (1901) and Taylor (1963). It seems that, where the fern-root plane is common, there is sound ethnographic evidence for fern-root in the

diet. The reasons for the lack of fern-root planes in the remainder of prehistoric New Zealand are probably complex. It is beyond the scope of this paper to enter into a review of the known dietary patterns of prehistory, though three possibilities for the varying prevalence of the fern-root plane are that the method of preparation varied, the method of chewing varied, or that fern-root in parts was relegated to a lesser level of importance in the diet.

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