

EXPERIMENTAL STUDY OF LINGUAL CARCINOMA BY DENTURE
IRRITATION: A PRELIMINARY REPORT

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Introduction

It has been suspected that decayed teeth or artificial dentures may be the cause of oral carcinoma for a considerable time. However, little work has been done to study the influence of mechanical irritation upon experimental oral carcinogenesis (1-6). This may be due to the fact that studies dealing with the influence of denture injury are lacking owing to the difficulty of denture insertion into experimental animals.

The authors have developed a one-piece metal denture of the maxilla of the rat (Fig. 1). The present experiment was undertaken as a preliminary test to investigate the conditions of denture insertion and suitability of this model for the study denture injury.

Materials and Methods

All animals used were Wistar male rats, 1 month old, about 35g in body weight. The animals were fed on a commercial stock diet (Oriental NMF) and received ad libitum.

In the past 2 years no lingual tumor has developed spontaneously in any of the Wistar rats kept in our laboratory.

The 21 rats used were divided into 4 groups: Group I (9 rats), a pellet of paraffin, containing 0.01 mg of the carcinogen (9, 10-dimethyl 1, 2-benzanthracene) was placed in the denture equipped with a rounded out cavity and inserted against the maxilla as a local irritant; Group II (5 rats), treated with denture irritation combined with a pellet of paraffin in the cavity; Group III (3 rats), treated with mechanical denture irritation alone; Group IV (4 rats), not treated in any way. The animals treated were kept under observation for 90 to 240 days.

The rats were examined histologically as they died, and those remaining alive until the 240th day were killed and examined histologically.

All animals found dead or sacrificed were fixed in formalin and a sagittal tissue slice of the tongue was excised, this was embedded in paraffin, prepared into sections of 6 to 8 μ thickness, and stained with hematoxylin and eosin for histological examination.

Results

Macroscopic Findings: Two or three days following the insertion of the denture in group I, II, III, the first symptom of ulceration appeared on or about the irritated site on the tongue (Fig. 2). The number of rats affected increased to 75 percent in these groups around the 25th day. These ulcerations tended to improve and healed with scar tissue formation (Fig. 3).

Thereafter no macroscopic changes were seen in the animals. But in some of the animals (35 percent) repeated ulceration was seen on the tongue. Around the 90th day of the experiment there was a small papillary growth beginning to appear on the tongue in one rat in Group I. Meanwhile no lesion was seen in the animals of Group IV.

At the time of gross examination, the oral mucosa was either free from changes or showed ulceration, scar tissue, or a small nodular growth.

Histological Findings: A small nodular growth which appeared in one rat in Group I showed indications of papillomatous hyperplasia of the mucous membrane with hyperkeratosis (Fig. 4, 5). 3 out of 9 rats in Group I and all 5 animals in Group II, macroscopically presented scar formation of the oral mucosa in the form of a mere thickening of the squamous epithelium with acanthosis accompanied by hyperkeratosis (Fig. 6). In contrast the squamous epithelium was merely thinned out, with or without subepithelial fibrosis in a few animals; this change was found in 2 rats in Group I and 1 out of 3 animals in Group III (Fig. 7). Ulcerative lesions showed an acute inflammatory condition characterized by destruction of the surface

epithelium and formation of ulcers. This change was found in 1 rat in Group I and in 2 in Group III.

Discussion

It is generally considered to be rather difficult to produce labial and lingual carcinoma by painting the oral mucosa with carcinogenic hydrocarbons. One of the authors repeatedly applied a 0.25% solution of 4-nitroquinoline 1-oxide (4NQO) and successfully produced labial and lingual carcinoma in a considerable proportion of the mice (1, 3, 4).

In this experiment, the incidence of cancer of the lower lip was significantly higher among the animals treated with 4NQO and injured with metal wire than in those treated with the compound alone. Chino and Kameyama (2) painted the lingual mucosa previously abraded by a dental cleanser in mice with a 0.25% solution of 4NQO in propylene glycol every weekday for 575 days. But the incidence of cancer of the tongue showed no significant difference between the animals treated with 4NQO following abrasion by a dental cleanser and those treated with 4NQO alone.

As early as 1935, Oyama (5) succeeded in producing lingual carcinoma with crude coal tar and by local mechanical stimulation with a metal ring in rabbits.

It is not certain whether this type of mechanical factor acts syncarcinogenically to induce oral carcinoma or cocarcinogenically to promote its growth after induction. The authors first experiment suggest that mechanical injury may enhance the incidence of carcinoma, but the second experiment

suggests the opposite which may not influence the incidence of carcinoma.

These results indicate that an irritant, insofar as it is mechanical, does not essentially vary in its effect with the locality of application on the oral mucosa as to whether the particular part of the mucosa stimulated is the lower lip or the tongue. It seemed that the difference of the effect of the mechanical irritant depended mainly on the difference of mode and means of its application. Accordingly, in this experiment mechanical irritation was undertaken by continuously stimulating the oral mucosa by dentures, and the results thus obtained are of interest in two respects. First, the denture was inserted over a long duration in the animals, and second, papilloma of the tongue was produced in a rat in Group I (denture + carcinogen).

This method may well serve for further investigations of carcinogenesis of the tongue.

Summary

A one-piece-cast metal denture was fixed onto the maxilla of the rat, and produced papilloma of the tongue. This method may well serve for further investigations of oral carcinogenesis.

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References

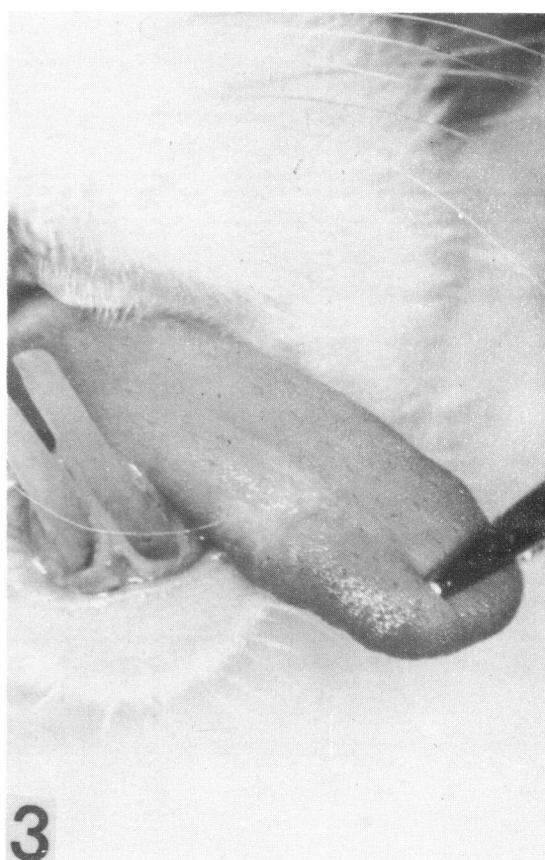
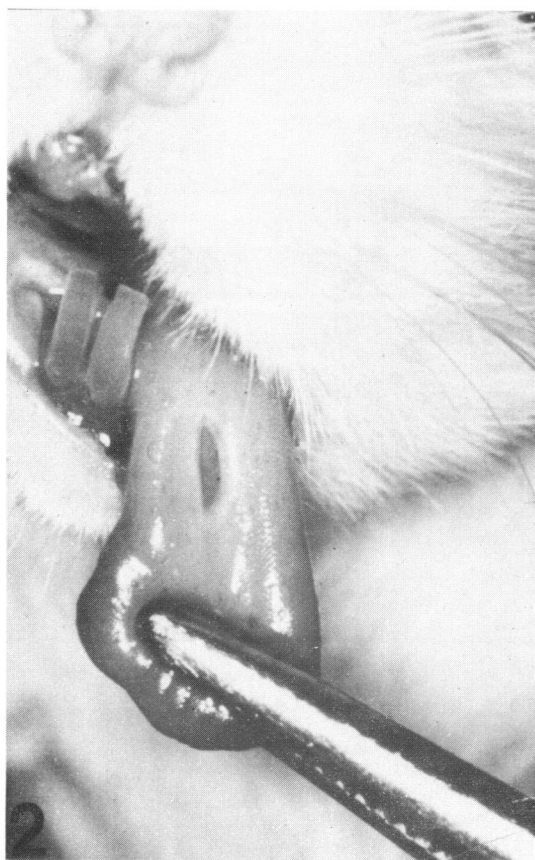
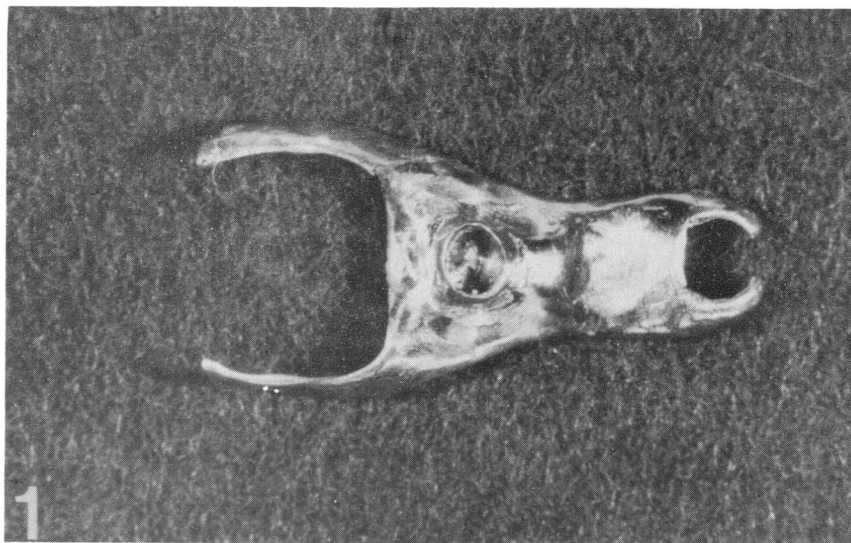
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Explanation of figures

Fig. 1 One-piece-cast metal denture used
in the experiment,

Fig. 2 Tongue of a rat in Group II, 11 days
after the initiation of the experiment.
Ulceration is apparent.

Fig. 3 Tongue of a rat in Group II, 52 days
after the initiation of the experiment.
Scar formation can be seen.



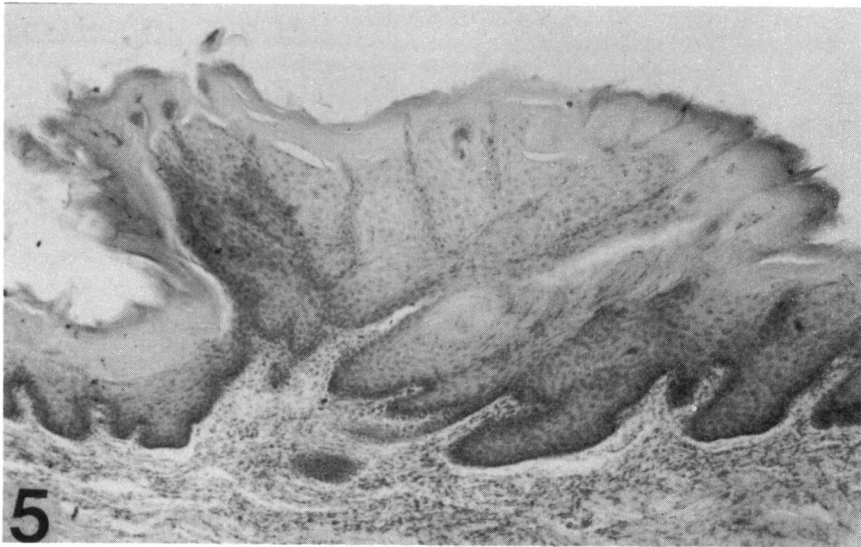
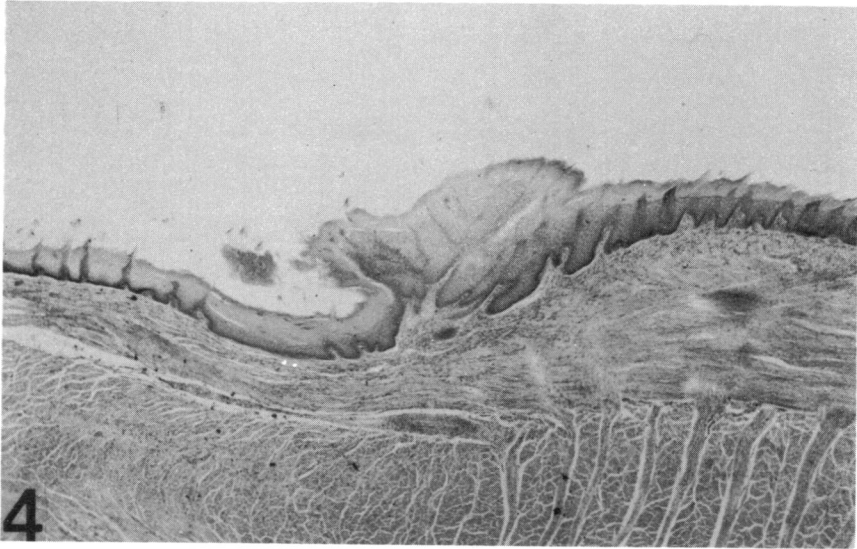


Fig. 4 A low-power view of a nodular growth
of small size (papillomatous hyperplasia).
H-E stain. X 24

Fig. 5 A medium-power view of Fig. 4.
H-E stain. X 60

Fig. 6 A low-power view of scar tissue with acanthosis and hyperkeratosis of the squamous epithelium and some signs of epithelial down growth. H-E stain. X 40

Fig. 7 A low-power view of scar tissue with atrophic epithelium and hyperkeratosis. H-E stain. X 60

