

The Hypophysis and the Teeth*

II. Effects of Replacement Therapy on the Eruption and the Histologic Changes of the Teeth of the Hypophysectomized Rat

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In order to establish the causal relationship between hypophysectomy and the dental changes observed in the experimental animals, replacement therapy was instituted.

In the preceding report of this series (Schour 1934), it was stated that the retardation in the rate of eruption of the incisor could be used as an early and reliable indicator of the success or failure of the operative removal of the pituitary gland. It, therefore, seemed worthwhile to use the rate of eruption measurements in order to test the efficacy of replacement therapy by the injection of the growth-promoting hormone.

Material. A series of seven hypophysectomized rats and their litter mate controls was treated for various periods with daily injections (usually twenty) of the growth-promoting hormone of the pituitary body. The experimental animals were operated upon at the age of 45-64 days. The rate of eruption of the incisors of these animals was measured for varying lengths of time preceding, during, and after replacement therapy (Table I).

Method. A horizontal marking with a fine file (Swiss jeweler's screw head file) was made near the gingival line along the disto-labial margin of the upper incisor. With an adjustable caliper provided with fine points, the distance was measured between the point where the marking crossed the disto-labial margin and the point where the surface of the gingivae crossed the same margin. This distance was read in twentieths of a millimeter with the aid of a stage micrometer and a dissecting microscope. The distance between the same points mentioned above was read seven days later. The difference between the two readings represented the rate of eruption for that period. New marks had to be made each week in the normally erupting teeth. Operated and control animals received the same preparation subcutaneously once daily in a dose proportional to the body-weight. The extracts were prepared by the method of van Dyke and Wallen-Lawrence and kindly furnished by the Wilson Laboratories.

Effect of Replacement Therapy on the Rate of Eruption of the Incisors

The rate of eruption of the rat incisors which is retarded following

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TABLE I

Effect of Growth-Promoting Hormone on Rate of Eruption of Upper Incisors and on the Histologic Structure of the Incisors and Molars of Hypophysectomized Rats

No. of Rats	Period of Injection		Maximum Weight Gain %	Effect on Rate of Eruption of Incisor Approx. average weekly rate of eruption in mm.			Effect on Histologic Structure			
	No. of Successive Days	Days Following Hypophysectomy		3 weeks preceding therapy	During therapy	% of Increase	Incisors		Molars	
							Alterations in rats with similar duration of post-operative life but without therapy	Alterations in the experimental rats which were subjected to therapy	Alterations in rats with similar duration of post-operative life but without therapy	Alterations in the experimental rats which were subjected to therapy
	20	54-73	60.7	.18	.95	427	†	†	†	—
	20	77-96	40.4	.36	.8	122	†	†	†	—
	20	89-108	0	0	0	0	histologic study not made			histologic study not made
	12	139-150	22.4	.1	.26	160	†	†	†	—
	21	125-145	21.7	.33	.66	100	††	borderline between † and ††	† or ††	—
	20	167-186	10.5	.27*	.63	137				
	20	224-243	0	.20	.1	0				
	21	294-314	27.4	.29	.51	75	†††	borderline between †† and †††	†††	—
	20	336-355	22.3	.27*	.45	66				
	20	393-412	0	.56	.38	0				
	17	412-428	0	0	0	0	†††	†††	†††	†††

*normal or very slight changes; †early disturbances; ††intermediate disturbances; ††† advanced disturbances.

† is average is based on the records of only two weeks preceding treatment.

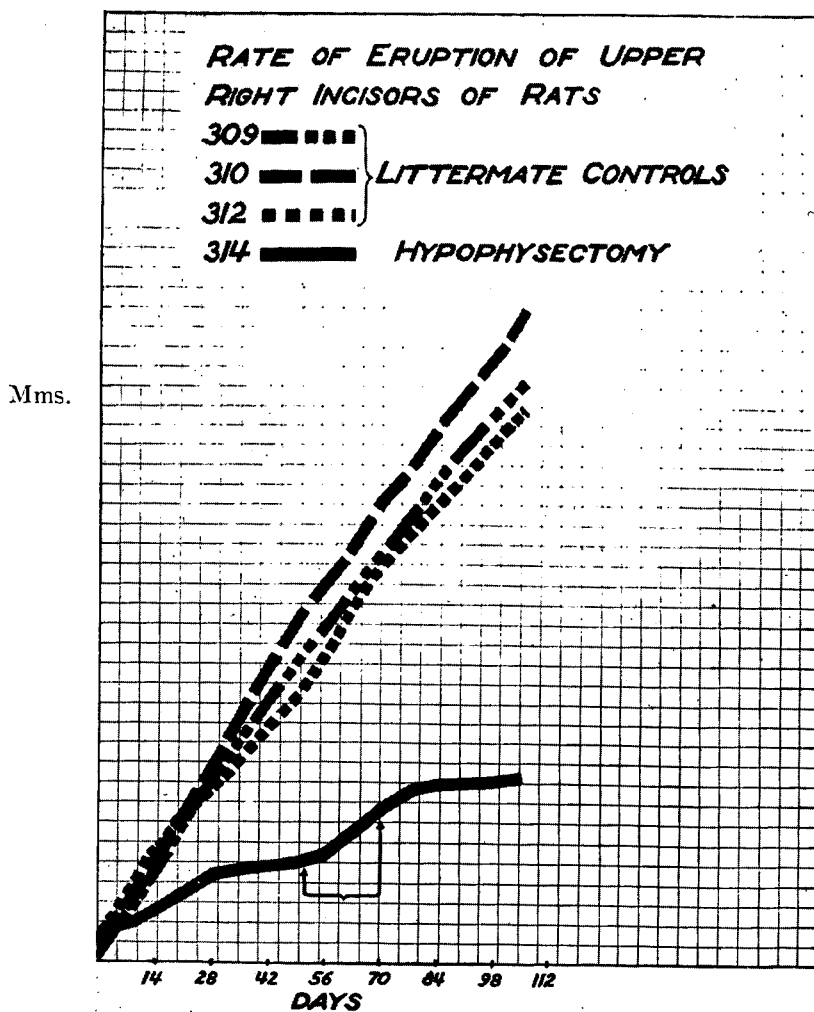


Figure 1. Effect of treatment on incisor-eruption rate of hypophysectomized rat 314 and litter-mate controls 309, 310 and 312. The brackets indicate the period of injections.

hypophysectomy can be accelerated by replacement therapy (Table II). The increase in the rate of eruption can be observed within a week following the beginning of replacement therapy and continues for about a week after treatment is stopped (Schour and van Dyke, 1932). Except for some individual variations, the acceleration is greatest in the animals operated upon most recently and appears to become smaller as the interval between the time of the operation and the time of replacement therapy increases (Table I, Fig. 1). Two animals that were given replacement therapy during the fourteenth month following hypophysectomy (Rats 186, 258) showed no change in the rate of eruption of their incisors (Fig. 2). Another animal (Rat 268) responded to replacement therapy when administered during the fifth and sixth month following the operation but showed no response to treatment during the eighth month following hypophysectomy. One animal (Rat 319) did not respond during the fourth month following hypophysectomy. The typical reaction of this animal may be associated with the fact that it was ovariectomized previous to the time of replacement therapy. However, in all the hypophysectomized animals, increase in weight and acceleration in eruption-rate were always associated.

The rate of eruption of the molars was not studied.

Effect of Replacement Therapy on Histologic Changes

In the incisors. Following replacement therapy, a significant modification of the histologic alterations in the incisor could not be recognized (Table I).

In the molars. With the exception of Rat 186, the molars showed a normal picture or only very slight changes in all the rats which were given injections of growth-promoting hormones (Table I). Replacement therapy apparently produced a practically normal histologic picture in Rats 258 and 268 which were given 3 periods of about 20 daily injections each and only a relatively slightly abnormal picture in Rats 314 and 324 which were given only one period of 20 daily injections.

The vascular changes which were characteristic particularly in the hypophysectomized animals of longer post-operative life were absent in the experimental animals of similar duration of post-operative life that were given replacement therapy. In Rat 186, however, 17 daily injections of the hormone of the anterior lobe of the hypophysis appeared to have no effect on the histologic changes following hypophysectomy. This lack of reaction may be readily associated with the fact that the hormone was administered during the 412-428th post-operative days. This animal similarly showed no response in its rate of eruption which was zero before replacement therapy and remained unchanged (Table I).

Comparison of the Effect of Replacement Therapy on Histologic

Changes in the Incisors and the Molars

Replacement therapy was found to be more effective in the molars. Here the histologic changes showed a more or less complete recovery depending on the number of the growth-hormone injections and on the length of post-operative life preceding treatment.

TABLE II
Comparison of Mean Rates of Eruption of Upper Incisors of Normal and Hypophysectomized Rats

Group	Number of Individuals	Number of Measurements	Mean weekly Eruption rate mm.	Standard Deviation mm.
I Control	14	190	1.980	± 0.377
II Treated Control	10*	49	2.028	± 0.838
III Hypophysectomized	5†	20	0.210	± 0.163
IV Treated Hypophysectomized	5†	26	0.610	± 0.324

*From Group I

†Same individuals

The difference in reaction between the incisor and the molar to replacement therapy is probably due to the fact that hypophysectomy produces in the incisors more severe alterations, not only in the dental tissues themselves but also in the relationship between the tooth and the alveolar bone. Prominent distortion of form, multiple foldings, and occasional ankylosis are found only in the incisor and are apparently instrumental in making replacement therapy less efficient in the incisor than in the molar. It is probable that a longer period of replacement therapy administered after a short post-operative life would confer complete normality to the incisor of the hypophysectomized rat.

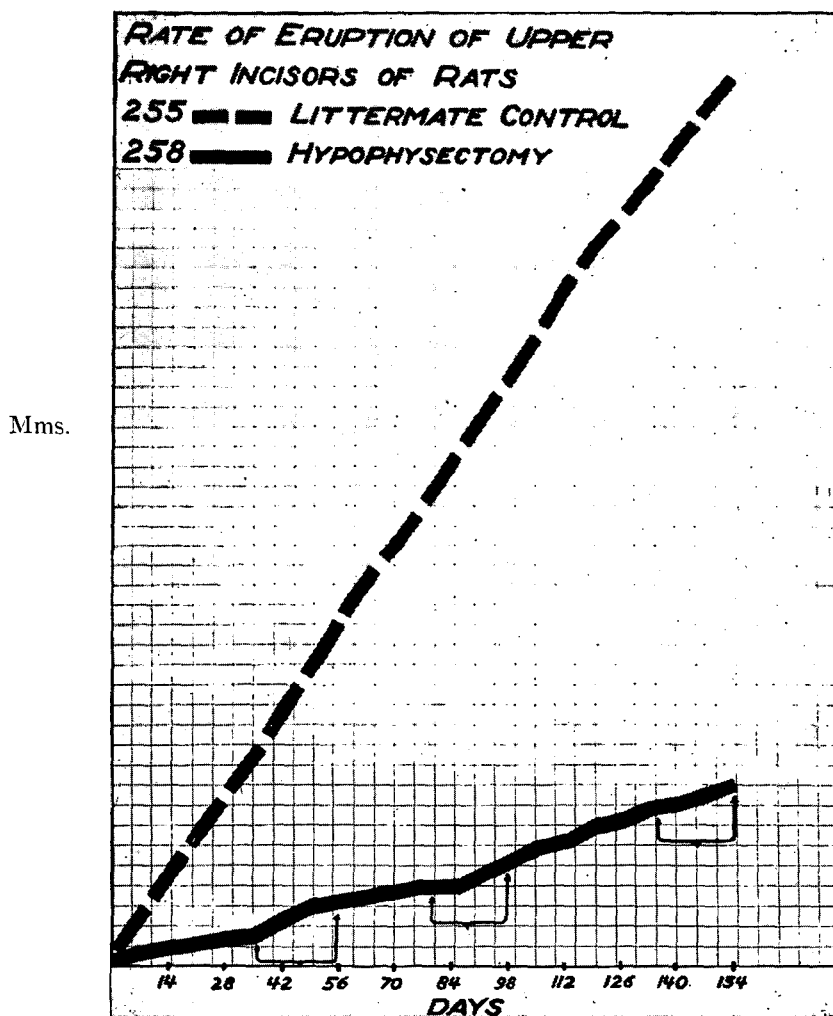


Figure 2. Effect of treatment on incisor-eruption rate of hypophysectomized rat 258 and litter-mate control 255. The brackets indicate the period of injections.

Conclusions

1. Following hypophysectomy, the eruption of the incisor of the rat becomes progressively slower and finally ceases.
2. If not administered too late after operation, growth-promoting hormone increases the eruption rate of the incisor. An increase in body-weight, following the administration of hormone to the hypophysectomized animal, is always associated with an increase in the rate of the eruption of the incisor.
3. In the normal animal, the administration of growth-promoting hormone under the experimental conditions described, although definitely increasing body-weight, does not appreciably alter the eruption-rate of the incisor.
4. The histologic alterations observed in the incisors of the hypophysectomized rat were not significantly modified by replacement therapy.
5. Replacement therapy tended to confer complete normality to the molar of the hypophysectomized rat in respect to the histologic structures.

Bibliography

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