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THE WATER CONTENT IN HUMAN GINGIVAL TISSUE

by

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A series of investigations is being undertaken with the purpose of examining the biological significance of the aqueous phase in the human gingiva. The first paper in this series was concerned with the proton magnetic resonance lines of the water in the gingiva (*Forsslund, Odeblad & Bergstrand,* 1962). A second paper dealt with the relative contribution by two mechanisms to hydration in complex biological material. These two mechanisms are (a) electric dipole interaction and (b) hydrogen bond interaction (*Odeblad & Forsslund,* 1962). The present paper deals with the water contents in the gingiva.

According to *Dominguez* (1950) and *Langley & Cheraskin* (1951) the water makes up about 65 per cent of the total body weight in man. The normal gingiva is built up of connective tissue with an epithelial layer. The diseased gingiva is more or less inflamed and the connective tissue may be substituted by granulation tissue. The epithelium may also be lost in these cases.

Some figures regarding the water content in different tissues are of interest in this connection: The water content in per cent

is according to *Wetzel* (1933) in elastic tissue 49.6, cartilage 55, striated muscle tissue 75, and, according to *Nordmann* (1954) and *Huggert & Odeblad* (1959), in cornea 75—80 and in sclera 65.

MATERIAL AND METHOD

In connection with oral surgery pieces of clinically healthy and diseased human gingivae were excised. None of the subjects presented signs of water or electrolyte disturbances. 30 samples were taken, two of which were destroyed by accidents. Each sample was immediately introduced into a small glass tube in such a way that no loss of water could occur during the storage. The tubes were sealed with wax, put in a refrigerator and later transferred to a freezing box (—23°C) for storage. Before weighing, the samples were allowed to take on room temperature (+20°C) and were subsequently centrifuged for 5—6 minutes down in the tubes to become homogeneous. The tube was then cut in half and from the lower part of the specimen about 4 mg of tissue was removed. This piece was divided into two parts. One part was used for the weighing experiment and the other part was examined microscopically after formalin fixation and paraffin embedding. Sections were stained according to *van Gieson* and with haemotoxylin-eosin. A *Mettler* balance was used, which could be read in grams with six decimals. The wet sample (about 1—2 mg) was weighed on a thin aluminium foil and then allowed to run dry in air on the foil at room temperature for two days. The samples handled in this way reached constant weights after 6—12 hours of drying. The content of water was calculated in per cent of the wet weight. The microscopic investigation determined whether there were inflammations or not in the tissues and whether the samples contained epithelium.

RESULTS AND DISCUSSION

The results of the investigation are presented in Table 1. From a pathologico-anatomic point of view the samples were classified in two groups, *i.e.* normal (N) and inflamed (D) gingiva. Samples containing epithelium were marked (E).

Table 1

Pathologico-anatomic diagnosis	Sample no.	Year	Water content in per cent of wet weight
N: E	20	9	59
N: E	4	33	60
N: E	9	36	53
N	18	38	59
N: E	1	39	84
N	22	42	60
N: E	5	44	64
N: E	10	44	66
N: E	3	47	65
N: E	13	49	52
N: E	15	49	52
N: E	17	51	65
N: E	6	53	67
N: E	11	54	66
N	29	62	66
N: E	2	64	60
Mean = 62.4. S.D. of the mean = 1.9			
D: E	27	20	66
D: E	21	42	68
D: E	23	42	58
D	12	43	66
D	8	47	71
D	7	54	69
D: E	16	54	65
D: E	24	57	69
D: E	25	57	58
D: E	26	57	59
D: E	28	62	49
D: E	30	62	72
Mean = 64.2. S.D. of the mean = 2.0			

Sample nos. 14 and 19 were destroyed.

The samples were classified into two groups, i.e. normal (N) and inflamed (D) gingiva. Samples containing epithelium were marked (E).

The average water content in human gingiva for the normal samples was 62.4 per cent (S.D. of the mean 1.9) and for the inflamed samples 64.2 per cent (S.D. of the mean 2.0). The range was 49—84 per cent. The difference is not significant. The water contents determined in this way are dependent on the temperature during the drying process. At higher drying temperature more of the strongly bound water will evaporate. The true water contents are therefore expected to be somewhat higher than the figures obtained here.

There was no striking correlation between age and water content.

SUMMARY

An investigation was made to obtain information on the water contents of the human gingival tissue. In all, 28 samples were examined (Table 1). From a pathologico-anatomic point of view the material was divided into two groups, normal (N) and inflamed (D). Most of the samples contained epithelium (E), too. The average values were for the normal group 62.4 per cent (S.D. of the mean 1.9), and for the inflamed group 64.2 per cent (S.D. of the mean 2.0). The range was 49—84 per cent.

RÉSUMÉ

TENEUR EN EAU DU TISSU GINGIVAL HUMAIN

Une étude a été effectuée dans le but d'obtenir des renseignements sur la teneur en eau du tissue gingival humain. 28 prélèvements ont au total été examinés (Tableau 1). Le matériel a été divisé en deux groupes du point de vue anatomo-pathologique: groupe normal (N) et groupe avec inflammation (D). La plupart des prélèvements contenaient aussi de l'épithélium (E). Les valeurs moyennes ont été de 62,4 % pour le groupe normal (erreur standard de la moyenne = 1,9) et de 64,2 % pour le groupe avec inflammation (erreur standard de la moyenne = 2,0). Etendue de la distribution: 49—84 %.

ZUSAMMENFASSUNG

WASSERGEHALT DES MENSCHLICHEN ZAHNFLEISCHGEWEBES

Eine Untersuchung wurde durchgeführt, um Aufschluss über den Wassergehalt des menschlichen Zahnfleischgewebes zu erzielen. Insgesamt wurden 28 Proben untersucht (Tafel 1). Das Material wurde auf Grund eines pathologisch-anatomischen Gesichtspunktes in zwei Gruppen geteilt, und zwar eine normale (N) und eine entzündete (D). Die meisten Proben enthielten auch Epithel (E). Die Durchschnittswerte betrugen für die normale Gruppe 62,4 % (Standardabweichung des Mittelwertes = 1,9) und für die Gruppe mit Entzündung 64,2 % (Standardabweichung des Mittelwertes = 2,0). Die Variationsbreite war 49—84 %.

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