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OCCLUSAL TACTILE THRESHOLD IN DENTURE WEARERS

by

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INTRODUCTION

The sensations in the parodontium associated with the guidance of the movements of the lower jaw disappear along with the loss of the teeth. These sensations are replaced in the mouth of a denture user by those induced by the different pressures of the prosthesis against the mucosa. Such sensations have an effect, furthermore, on the perioral muscles that helps to keep the denture in place. It has been observed that when the mucous membrane of the mouth is anesthetized, the retention of prostheses weakens (*Brill et al.*, 1959).

Denture wearers describe that the sensations experienced with prostheses in response to tactile stimuli are duller than those conveyed by natural teeth. How true is this feeling, and how great is the difference? This question led to the present authors' previous study on the tactile sensibility of the parodontium to slight axial loadings of the teeth (*Siirilä & Laine*, 1963). In the present study the same method was applied to obtain answers to the following questions:

1. Does the sensory threshold of artificial teeth differ from that of natural teeth in detecting tiny bodies placed between the occlusal surfaces?
2. Are there individual or sex differences in this respect?

Answers to similar questions were sought as early as 1933 by *Hollstein*, who investigated the sensory threshold of teeth by means of thin pieces of platinum wire placed between the occlusal surfaces, especially in the case of teeth-supported removable partial dentures acting as antagonists. The mean sensory threshold thereby obtained was 0.16 mm — while with crowns and bridges the corresponding figure was 0.066 mm, and with natural teeth 0.058 mm. Studies on the tactile sensibility of teeth are reported according to *Hollstein* in the literature as dating back as long ago as 1867.

Later studies are scanty. *Manly et al.* (1952) compared the sensory threshold values yielded by natural and artificial teeth, focusing attention on sensibility to detect differences of thickness and hardness. The general conclusion arrived at was that the tactile sensations experienced with prostheses were quite as accurate as those with natural teeth whenever considerable force should be exerted, but that slight pressures and movements could not be differentiated equally well with dentures. *Brill et al.* (1962) reported that a 0.06 mm body could be detected between the occlusal surface of complete dentures.

MATERIAL AND METHODS

The subjects were picked at random from among the patients being treated at the Department of Prosthetics, Institute of Dentistry, University of Helsinki. The patients were previous denture wearers for each of whom a complete mucosa-borne denture had just been made and none of whom had experienced any disturbances in temporomandibular joints. The material consisted of 18 subjects. Previous denture wearers were desired as subjects because they would have had time to develop sensory reflexes, while new prostheses were desired because resorption of the alveolar process would not yet have taken place with a consequent deterioration of occlusion. The sex, age, type of denture and time during which previous prostheses were worn are presented in Table I. The new dentures had been worn not less than a week following the grinding of occlusion and articulation.

The method of study, together with its accuracy and sources of error, has been described in detail in a previous paper published by the authors (*Siirilä & Laine*, 1963). The bodies placed between the teeth were pieces of tin foil. The reliability of these tests was measured by placing each piece, unseen by the subject, ten times on the occlusal surface of some teeth in the lower jaw, five times in reality and five times only ostensibly. The sensory thresholds presented in the following have been determined according to a perception series in which at least four out of the five actual pieces of foil

were detected and not a single mistaken detection was made of a body never actually placed between the teeth. The test pieces were placed on only one spot in the dental arch, where by means of articulating paper a clear contact was established.

RESULTS

The slightest surely and unerringly detected thicknesses of foil are presented in Table I. The mean sensory threshold was 0.18 mm, the median 0.15 mm and the extreme values 0.03 mm and 0.60 mm. No significant difference between the sexes could be observed in the values.

DISCUSSION

The great differences reported in the results between the threshold values either represent actual individual differences in the tactile sense or they are likely to reflect varying degrees of success achieved with dentures. They may further also be due to varying resilience in the supporting soft tissue.

Table I.
Occlusal tactile threshold values and distribution of material according to sex and age, type and duration of wear of previous denture

| Sex | Age | Type of previous denture | Years worn | Thickness of unmistakably perceived foil (mm) |
|-----|-----|--------------------------|------------|-----------------------------------------------|
| ♂ | 41 | F/P | 2 | 0.30 |
| ♂ | 48 | F/F | 25 | 0.12 |
| ♂ | 54 | P/P | 3 | 0.24 |
| ♂ | 65 | F/P | 6 | 0.24 |
| ♂ | 69 | F/P | 10 | 0.18 |
| ♂ | 78 | P/— | 12 | 0.60 |
| ♀ | 42 | F/F | 12 | 0.06 |
| ♀ | 48 | F/— | 10 | 0.12 |
| ♀ | 52 | F/F | 5 | 0.12 |
| ♀ | 54 | F/F | 20 | 0.12 |
| ♀ | 54 | P/P | 31 | 0.18 |
| ♀ | 59 | F/— | 18 | 0.12 |
| ♀ | 60 | F/F | 38 | 0.03 |
| ♀ | 64 | F/P | 8 | 0.12 |
| ♀ | 67 | F/P | 7 | 0.24 |
| ♀ | 68 | F/P | 20 | 0.36 |
| ♀ | 72 | F/P | 10 | 0.12 |
| ♀ | 74 | F/F | 25 | 0.18 |

An effort was made to lessen the influence of the latter factors by limiting the study to subjects with new dentures and checking the occlusion in each case with maximum care. It nevertheless remained unsolved at what point in the chain of tactile sensory responses the differences originate. In any event, the results obtained reflect differences among patients for whom every effort was made to produce equally serviceable dentures. Individual differences were also perceived in the tactile sensibility of natural teeth, the range of variation being 0.008—0.03 mm (*Siirilä & Laine, 1963*). On the basis of the present findings it is concluded that the sensory threshold in dentu wearersre in detecting bodies placed between the occlusal surfaces is approximately six times that of natural teeth.

SUMMARY

The material of the present study consists of 18 wearers of a complete denture who had previously worn a mucosa-borne denture and for whom a new denture had just been made. The sensory threshold was sought in the same way as previously described (*Siirilä & Laine, 1963*) by using pieces of tin foil.

The slightest thicknesses in the bodies placed between the teeth of dentures that were surely and unerringly detected are presented in Table I. The mean sensory threshold is 0.18 mm, the median 0.15 mm, and the extreme values 0.03 mm and 0.60 mm.

The sensory threshold in the detection of bodies placed between the occlusal surfaces of mucosa-borne dentures was approximately six times that of natural teeth. No significant differences could be perceived between the values registered for the two sexes.

RÉSUMÉ

SEUIL TACTILE OCCLUSAL CHEZ LES PORTEURS DE PROTHÈSES

Le matériel de cette étude se compose de 18 sujets porteurs d'une prothèse complète, ayant auparavant porté une prothèse à support muqueux, et venant de recevoir la nouvelle prothèse. La recherche du seuil de la sensibilité a été faite suivant la méthode décrite précédemment (*Siirilä & Laine, 1963*), en utilisant des morceaux de feuille d'étain.

Le tableau I indique les plus petites épaisseurs des corps étrangers qui, placés entre les dents des prothèses, pouvaient être décelés avec certitude

et sans erreur. La valeur moyenne du seuil de la sensibilité était 0,18 mm, la médiane était 0,15, et les valeurs extrêmes étaient 0,03 mm et 0,60 mm.

Lors de la détection de corps étrangers placés entre les surfaces occlusales des prothèses, les seuils de la sensibilité étaient environ six fois plus élevés que lorsqu'il s'agissait des dents naturelles. Aucune différence significative n'a pu être constatée suivant le sexe.

ZUSAMMENFASSUNG

OKKLUSALES TAKTILES UNTERSCHIEDSVERMÖGEN BEI PROTHESENTRÄGERN

Das Untersuchungsmaterial bestand aus 18 eine totale Prothese tragenden Patienten, die schon früher einen Plattenersatz trugen, denen aber neue Prothesen angefertigt wurden. Die Bestimmung der Unterschiedsschwelle erfolgte auf eine von uns früher dargestellte Weise (*Siirilä & Laine, 1963*) mit Zinnfolien.

Der Durchschnittswert der Unterschiedsschwellen betrug 0,18 mm, der Medianwert 0,15 mm und der Grenzwert 0,03 und 0,60 mm.

Die Unterschiedsschwelle für die von den Okklusionsflächen der Plattenersätzzähne wahrgenommene Fremdkörpergröße ist mit dem entsprechenden Wert der natürlichen Zähne verglichen ungefähr die Sechsfache. Geschlechtliche Unterschiede in den Werten waren nicht signifikant.

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