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A TOPOGRAPHICAL CLASSIFICATION OF THE ORAL MUCOSA SUITABLE FOR ELECTRONIC DATA PROCESSING

ITS APPLICATION TO 560 LEUKOPLAKIAS

by

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INTRODUCTION

Earlier topographical classifications of the oral mucosa (*Balogh*, 1960; *Moore & Catlin*, 1967; *World Health Organization*, 1967) have not been primarily intended for follow-up studies of oral precancerous conditions and are not, therefore, sufficiently detailed for this special purpose. Furthermore, the classifications proposed by *Balogh* (1960) and by *Moore and Catlin* (1967) are not based on delineation of the regions by well known gross anatomical structures, and thus may not be reproducible by other investigators.

The present classification has been produced with the hope of overcoming both of the difficulties mentioned.

It could be foreseen that, although registration would be relatively easy to handle in the clinic, the quantity of data created might make conventional dataprocessing too laborious. The set-up of the classification was therefore modified to fit into electronic data processing (EDP).

The classification presented here may be used for the topographical registration of any disease of the oral mucosa, but as it has been developed as

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part of a current study in oral leukoplakia as a precancerous condition (*Pindborg et al.* 1968), its application to this particular disease is demonstrated.

It may be emphasized, that the location registration is only part of the overall EDP registration system designed to cover anamnestic, clinical and histological aspects of this follow-up study. The result of the work with the location registration is presented separately, because several requests for such a report have been put forward from research workers in the field of oral precancerous conditions.

For this study leukoplakia of the oral mucosa has been defined as a white patch or plaque, not less than 5 mm in diameter, which cannot be removed by rubbing, and which cannot be classified as any other diagnosable disease. Thus leukoplakia is used as a purely clinical diagnosis and does not carry any histologic connotation (*Shafer & Waldron*, 1961; *Pindborg et al.*, 1965; *Pindborg et al.*, 1966; *Zachariah et al.*, 1966; *Einhorn & Wersäll*, 1967; *Pindborg et al.*, 1967; *Pindborg et al.*, 1968; *Silverman et al.*, 1968).

CLASSIFICATION OF THE ORAL MUCOSA

Full description of the regions is presented in the Appendix. The vermilion border is not included in the classification. Each region has been given a locationcode (the number in parenthesis) which may be used for EDP (Appendix). A diagram of the oral cavity in which location-codes are shown, is given in Fig. 1. As may be seen from the instructions accompanying the diagram it is possible at the time of registration to differentiate between the edentulous alveolar ridge and the toothbearing alveolar process. For data processing 32 columns of the data-card are punched, using the following codes for each tooth — 0: tooth not present, 1: tooth present in area without leukoplakia, and 2: tooth present with leukoplakia of marginal or attached gingiva. Data treatment relating to this special point is then carried out in two steps: First the 32 columns for tooth registration are searched for patients having leukoplakias in relation to teeth. Next the cards for the patients left over from this phase are searched for leukoplakias of the edentulous alveolar process according to the 41 region classification.

As many leukoplakias include more than one region, two new terms have been introduced. *Main-location* is defined as the region in which a leukoplakia has developed, or — in cases, where the leukoplakia includes more than one area at the first examination — the region in which the center of

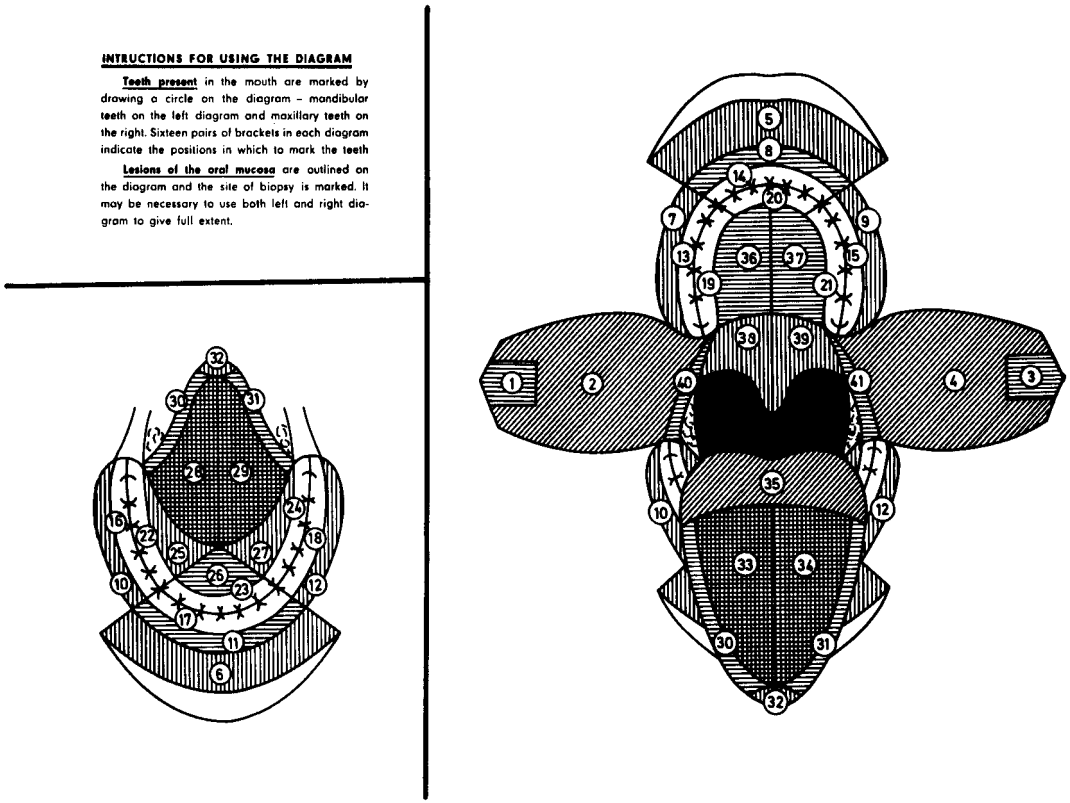

Fig. 1. Regional division of the oral mucosa with location codes.

the lesion is found. *Extension-locations* include any other region affected by a given leukoplakia.

Figures 2 and 3 illustrate the use of the classification and the diagram. At the first examination, in 1956, this patient had a leukoplakia of the right side of the palate. Since then it has gradually spread to the present size. By definition region 36 is then the main-location, whereas the other 15 regions affected are extension-locations.

For data processing main- and extension-locations are given separate columns on the data-card. In this way it is possible to ascertain not only how many leukoplakias a given sample may contain, but also how often a given region is affected, be it by massive involvement by leukoplakia or only by a slender extension from a leukoplakia sited for the main part in

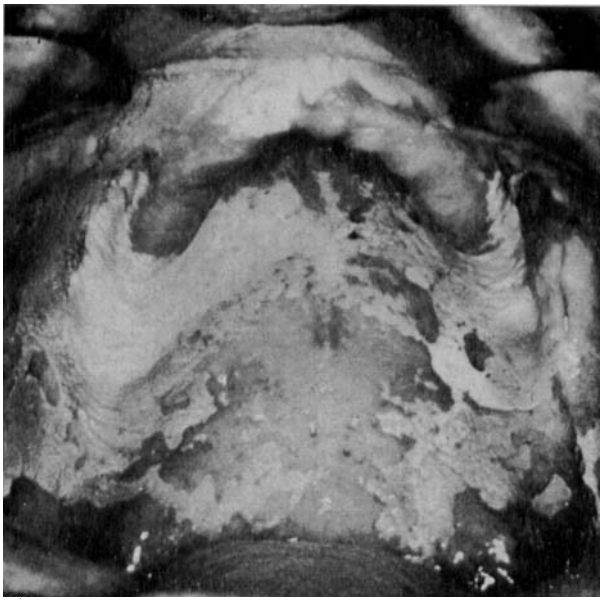

Fig. 2. Leukoplakia in a 64 year old woman. In the left side of the hard palate is found an incipient carcinoma near the anterior margin of the leukoplakia.

another region. The patient presented above developed cancer near the margin of an extension-location, thus illustrating the biologic importance of making this distinction in registration.

MATERIAL AND METHODS

During the years 1956 to 1967 inclusive, 299 patients with a total of 560 leukoplakias were admitted for examination and treatment at the Dental Department, University Hospital and the Department of Oral Surgery, Royal Dental College, Copenhagen. These 299 patients comprised 175 males and 124 females. The mean age for males was 54.0 years (SD 13.1 years). The corresponding figures for females were: mean age 55.3 years (SD 12.6 years). The patients have been followed up with regular control examinations (*Pindborg et al.*, 1968), but the present results pertain to the status at the first examination only, as comprehensive data for the natural history of oral leukoplakia will be presented in a separate paper.

Statistical analysis has been carried out by means of the chi-square test.

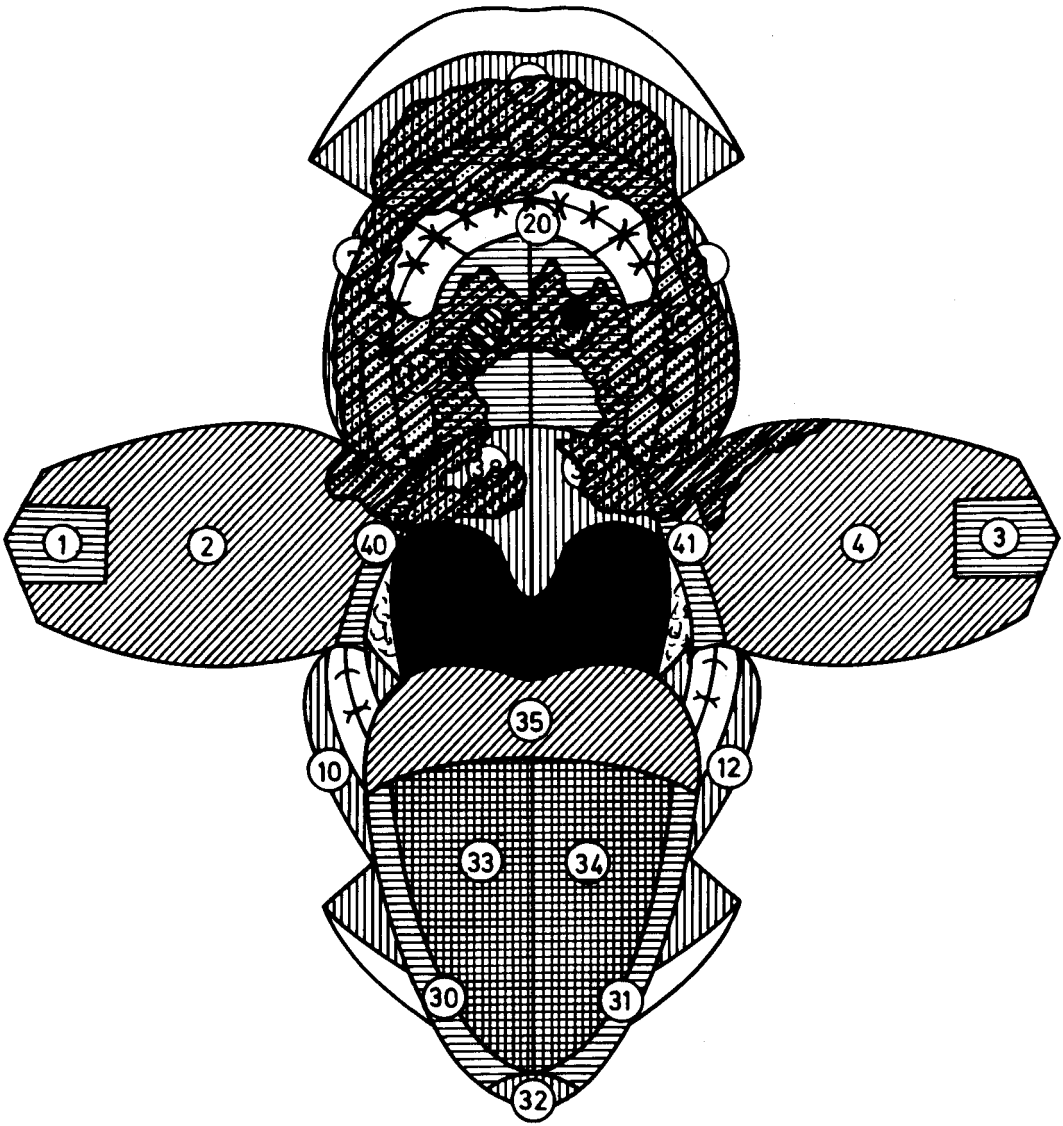

Fig. 3. Scematical presentation of the lesion shown in Fig. 2. The original size of the leukoplakia seven years earlier is superimposed on the right side of the hard palate, and the carcinoma is indicated.

RESULTS

For reasons of clearness several of the 41 regions have been combined (Fig. 4). When the proposed topographical classification is used for the registration of oral leukoplakias, it becomes obvious that extension involvement is a common feature. Figure 4 also shows that the buccal mucosa is the region most involved by leukoplakia (26.9 per cent). However, the labial commissures also are clearly distinguished from the rest of the regions, showing involvement to the extent of 20 per cent. Among the regions most seldom affected is found the tip of the tongue, presenting only one instance or 0.1 per cent. In this study the base of the tongue has not been observed to exhibit leukoplakia.

Evaluation of the relative frequencies has revealed no right- or left-sided predilection among paired regions. Differences are found, however, if the

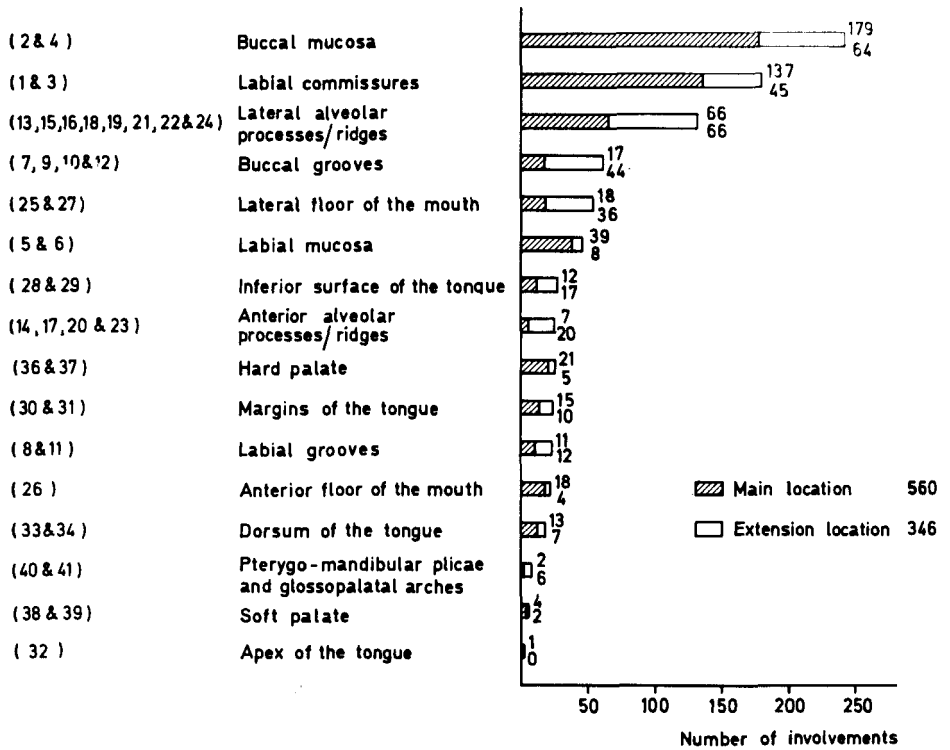

Fig. 4. Topographic distribution of 560 oral leukoplakias according to main location and extensions. For each bar the upper figure pertains to main location and the lower to extension location.

oral cavity is subdivided into an upper and a lower part for the following paired regions: labial mucosa, labial and buccal grooves, and right, left and anterior alveolar processes or alveolar ridges. This subdivision is demonstrated in Fig. 5. It is evident that the lower part of the oral cavity is, for all

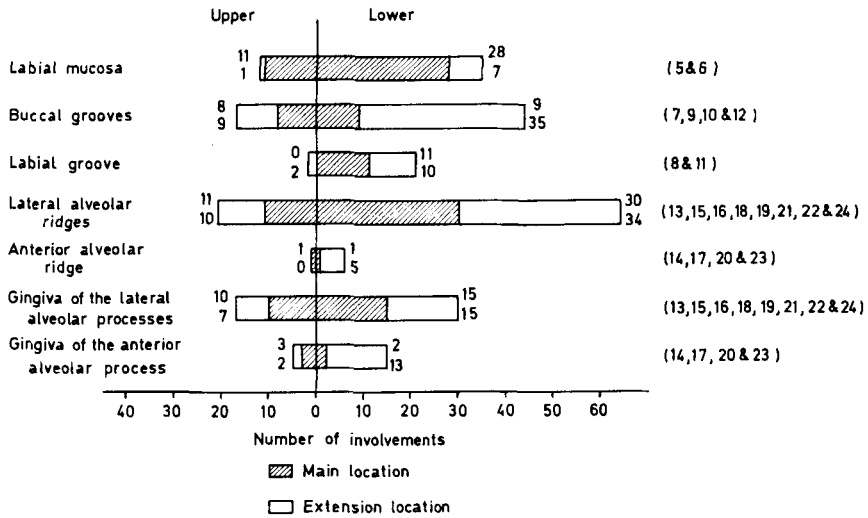

Fig. 5. Distribution of 140 leukoplakias involving the mucosa of the upper and the lower jaw, and of surrounding comparable regions.

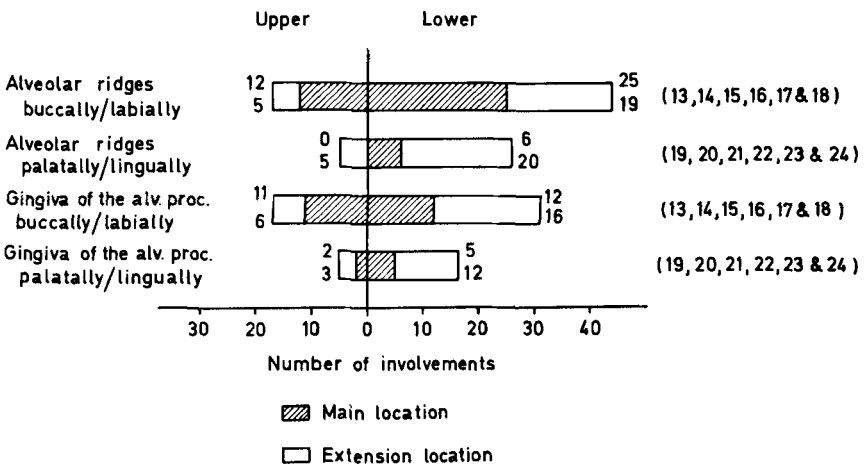

Fig. 6. Distribution of 73 leukoplakias involving the edentulous alveolar ridges or the tooth-bearing alveolar processes.

the comparable regions, more often affected than the upper part, the ratio being 215:75. This difference is significant ($p<0.001$). It is also clear that the edentulous alveolar ridge is the site of leukoplakia more often than the toothbearing alveolar process, in the ratio of 92:67. This difference, too, is significant ($0.025<p<0.05$).

Fig. 6 demonstrates that for both the maxilla and mandible the buccal or labial surfaces are more frequently the site of leukoplakia than are the lingual or palatal surfaces, ($p<0.001$). This is true for all regions of the alveolar ridge and tooth-bearing alveolar process.

DISCUSSION

The concept of main- and extension-locations presented here is flexible enough to be used for small, incipient lesions, and also for large, progressive ones, be they innocuous, precancerous or carcinomatous.

The authors are well aware, that a 41 region classification of the oral mucosa may at a first glance seem too extensive and sophisticated. However, it is our experience in working with this classification, that it provides for combinations, which could otherwise not have been established. Thus it has been possible to combine the regions of the floor of the mouth and the undersurface of the tongue (*Roed-Petersen et al.*, 1969). These regions show highly comparable mucosa, and consistently leukoplakias located there differentiate themselves from leukoplakias of the rest of the oral cavity.

One of the results of the analysis of the present material was that for comparable regions of the lower and upper parts of the oral cavity the ratio of leukoplakic involvement was 215:75. In 1967 *Moore and Catlin* observed that roughly 75 per cent of the cancers in their material occurred in the floor of the mouth and the alveolo-lingual sulcus. The two samples are not fully comparable as to regional classification, but it is interesting to note that they show the same tendency when the preponderance of buccal and commissural leukoplakias is removed from the present series. This may indicate that in a Danish population leukoplakias of the buccal and commissural areas may be of a different nature from those of the rest of the oral cavity. A study is now being carried out to eluciate this feature with special reference to the possible role of candida infection.

Leukoplakia proved to be encountered more often on the edentulous alveolar ridge than on the tooth-bearing alveolar process. This may be explained by the age distribution of the sample, as a simple consequence of the fact that patients in the age groups predisposed to leukoplakia will often be edentulous. Another factor to take into consideration is, however, the

possible effect of dentures. It is hoped that further analysis of the present material may clarify this point.

In this study no case of leukoplakia of the base of the tongue was seen, and the tip of the tongue was involved in leukoplakia in only one patient. Finally it was demonstrated that the vestibular surface of the alveolar ridges and processes are more often affected than are the lingual or palatal surfaces. At present no explanation of any of these facts can be given.

APPENDIX

Topography of the oral mucosa

General remarks

Expressions of geometry are used to indicate the approximate shape of a given area.

The term alveolar ridge is applied when the alveolar process is edentulous.

Labial commissure (1 & 3)

A square of 2×2 cm of the mucous membrane extending 2 cm distally from the corner of the mouth (angulus oris), covering 1 cm on each side of the occlusal line.

Buccal mucosa (right/left) — (2 & 4)

A rectangular area extending from the commissural area to the pterygo-mandibular plica, and from 1 cm below the top of the upper buccal groove to 1 cm above the bottom of the lower buccal groove.

Upper labial mucosa (5) and lower labial mucosa (6)

A rectangular area between lines drawn from the corner of the mouth to the regions of the distal surfaces of the upper/lower canines, extending from the vermilion border to 1 cm below/above the top/ bottom of the upper/ lower labial groove.

Upper buccal groove (right/left) — (7 & 9), and lower buccal groove (right/left) — (10 & 12)

A rectangular area posterior to the regions of the distal surfaces of the canines, back to the pterygo-mandibular plica and between the buccal mucosa and the upper/lower mucoalveolar junction.

Upper labial groove (8), and lower labial groove (11)

A rectangular area between the regions of the distal surfaces of the upper/lower canines and between the upper/lower lip and the upper/lower muco-alveolar junction.

Upper alveolar process (ridge) bucally (right/left) — (13 & 15), and lower alveolar process (ridge) bucally (right/left) — (16 & 18)

A rectangular area posterior to the regions of the distal surfaces of the upper/lower canines extending to the pterygo-mandibular plica and from the top of the alveolar process (ridge) to the upper/lower muco-alveolar junction.

Upper anterior alveolar process (ridge) labially (14), and lower anterior alveolar process (ridge) labially (17)

A rectangular area between the regions of the distal surfaces of the canines and extending from the top of the alveolar process to the upper/lower muco-alveolar junction.

Upper alveolar process (ridge) palatally (right/left) — (19 & 21), and lower alveolar process (ridge) lingually (right/left) — (22 & 24)

A rectangular area posterior to the regions of the distal surfaces of the canines extending to the pterygo-mandibular plica and above/below the top of the alveolar process to the junction between the horizontal and vertical part of the palate/the lingual muco-alveolar junction.

Anterior upper alveolar process (ridge) palatally (20), and anterior lower alveolar process (ridge) lingually (23)

A rectangular area between the regions of the distal surfaces of the upper/lower canines and from the top of the alveolar process to the palatal rugae (plicae palatinae transversae)/the lingual muco-alveolar junction.

Floor of the mouth (right/left) — (25 & 27)

A triangular area posterior to lines drawn from the regions of the distal surfaces of the lower canines to the frenulum linguae, and between the sub-lingual sulcus and the lower alveolar process (ridge) lingually (right/left), back to the pterygo-mandibular plica.

Anterior floor of the mouth (26)

A triangular area between lines drawn from the regions of the distal surfaces of the lower canines to the lingual frenulum, and the anterior lower alveolar process (ridge) lingually.

Inferior surface of the tongue (right/left) — (28 & 29)

A triangular area from the sublingual sulcus following the midline to 1 cm posterior to the tip of the tonque, and following an imaginary line 1 cm medially to the edge of the tongue (right/left).

Margin of the tongue (right/left) — (30 & 31)

A rectangular area 1 cm posterior to the tip of the tongue back to the pterygo-mandibular plica and covering 1 cm on each side of the edge of the tongue (right/left).

Apex of the tongue (32)

A circular area with a radius of 1 cm and with the center at the tip of the tongue.

Dorsum of the tongue (right/left) — (33 & 34)

A triangular area posterior to the apex area back to the terminal sulcus and between an imaginary line 1 cm medially to the edge of the tongue and the median lingual sulcus.

Base of tongue (35)

A rectangular area posterior to the terminal sulcus and between the two pterygo-mandibular plicae.

Hard palate (right/left) — (36 & 37)

A triangular area between the upper alveolar process (ridge) palatally, the raphe palati, and the junction of the hard and soft palate.

Soft palate (right/left) — (38 & 39)

A rectangular area posterior to the junction of the hard and soft palate, and between the pterygo-mandibular plica, and the midline, involving half the uvula.

Pterygo-mandibular plica and glosso-palatal arch (right/left) — (40 & 41) The mucosa covering the pterygo-mandibular raphe and the glosso-palatal muscle.

To comply with the "Manual of the international statistical classification of disease, injuries, and causes of death" by the World Health Organization (1967), the vermilion borders may be included in the present topographical classification by assigning a code of 42 to the upper and a code of 43 to the lower vermilion border.

SUMMARY

In view of the lack of detail in earlier topographical classifications of the oral mucosa a new 41-region classification is suggested; this has the added advantage of being suitable for electronic data processing. A special feature is the possibility of differentiating between the edentulous alveolar ridge and the tooth-bearing alveolar process. The use of the classification is illustrated by reference to a clinical case of leukoplakia.

Application of the method to 560 leukoplakias in a Danish series revealed that leukoplakia was more common:

1) in the buccal and commissural mucosa compared to other regions.
2) in the lower part of the oral cavity compared to matched regions of the upper part.
3) on the edentulous alveolar ridges compared to the tooth-bearing alveolar processes.
4) on the buccal and labial aspects of alveolar processes or ridges compared to the lingual or palatal aspects.

Finally it is shown, that the distribution of leukoplakias in this material matches well with distributions reported for oral carcinomas, provided the preponderance of buccal and commissural leukoplakias is removed from the present series. This may mean, that in a Danish population leukoplakias of the buccal and commissural areas may be of a nature different from those of the rest of the oral cavity.

RÉSUMÉ

UNE CLASSIFICATION TOPOGRAPHIQUE DE LA MUQUEUSE BUCCALE UTILISABLE POUR LE TRAITEMENT ÉLECTRONIQUE DE L'INFORMATION SON APPLICATION A 560 LEUCOPLASIES

Les classifications topographiques de la muqueuse buccale établies antérieurement étant peu détaillées, les auteurs proposent ici une nouvelle classifi-

cation en 41 régions; cette classification présente de plus l'avantage d'être utilisable pour le traitement électronique de l'information. Une de ses particularités est la possibilité de distinguer entre la crête alvéolaire édentée et le procès alvéolaire denté. L'utilité de la classification est illustrée par la mention d'un cas clinique de leucoplasie.

En appliquant au Danemark cette méthode dans une série de 560 leucoplasies, on a mis en évidence que la leucoplasie était plus fréquente:

1) au niveau de la joue et de la commissure labiale qu'au niveau des autres régions.
2) dans la partie inférieure de la cavité buccale que dans les parties correspondantes de la partie supérieure.
3) sur les crêtes alvéolaires édentées que sur les procès alvéolaires dentés.
4) sur les parties vestibulaires (buccales et labiales) des procès et des crêtes alvéolaires que sur leurs parties linguales ou palatines.

Il est enfin montré que la répartition des leucoplasies dans ce matériel correspond bien aux comptes-rendus existant sur la répartition des carcinomes de la cavité buccale, à condition que l'on élimine de la présente série la prépondérence des leucoplasies de la joue et de la commissure labiable. Ce fait pourrait indiquer que, dans une population danoise, les leucoplasies existant au niveau de la joue et de la commissure seraient d'une nature différente de celles des autres régions de la cavité buccale.

ZUSAMMENFASSUNG

TOPOGRAPHISCHE KLASSIFIKATION DER MUNDSCHLEIMHAUT AN ELEKTRONISCHE DATABEHANDLUNG BEABSICHTIGT. IHRE VERWENDUNG AN 560 LEUKOPLAKIEN

Aus Mangel an Einzelheiten früheren topographischen Klassifikationen wird eine neue 41-Regionen Klassifikation vorgeschlagen. Diese hat den weiteren Vorteil an elektronische Databehandlung verwendbar zu sein. Eine spezifische Eigenschaft ist die Möglichkeit zwischen zahnlosen und bezahnten Processus alveolaris unterscheiden zu können. Die Anwendung der Klassifikation wird durch einen klinischen Fall von Leukoplakie illustriert.

Verwendung der Methode an 560 Leukoplakien eines dänisches Materials hat gezeigt, dass Leukoplakie kommt haüfiger vor:

1) in der Schleimhaut der Wangen und Kommissuren als in anderen Regionen,
2) im unteren Teile der Mundhöhle als in vergleichbaren Regionen des oberen Teils,

3) an zahnlosen als an bezahnten Processus alveolaris, und
4) an buccalen und labialen Seiten des Processus alveolaris als an lingualen oder palatinalen.

Schliesslich wird gezeigt, dass die Verteilung der Leukoplakien dieses Materials mit der veröffentlichten Fällen von oralen Krebs wohl übereinstimmt, vorausgesetzt dass das übergewicht von buccalen und kommissuralen Leukoplakien aus dem vorliegenden Krankengut entfernt wird. Dies mag weiter bedeuten, dass die Leukoplakien der buccalen und kommissuralen Regionen in einer dänischen Population von einer anderen Natur sind als die der übrigen Regionen der Mundhöhle.

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