META-ANALYSIS OF THE LITERATURE ON 1946 CASES OF MINOR SALIVARY GLAND TUMORS OF THE PALATE

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ABSTRACT

Minor salivary gland tumors are relatively rare and exhibit great diversity in terms of histopathology, localization, biological behavior and classification.

The studies of significant case series report controversial data, mainly in terms of the proportion of benign versus malignant tumors and the relative frequency of histological types. Palate tumors are the most frequent, with an incidence of over 50%. The aim of the present study was to perform a meta-analysis to evaluate salivary gland tumors of the palate in terms of the proportion of malignant versus benign tumors, the frequency of the histological types and the data employed for statistical analysis. We analyzed a selection of international publications (1950-1999) of case series of minor salivary gland tumors of the palate, including our own series. The host institutions were classified into 3 categories: A) High Complexity Institutions (HCI), i.e. oncological reference centers and general hospitals that treat cancer patients; B) Medium Complexity Institutions (MCI); C) Low Complexity Institutions (LCI). Based on the main classifications, we joined categories and employed a simplified classification to analyze a total of 1835 cases in the literature and our own series of 111 cases (unpublish data).

The results of the meta-analysis of the literature demonstrated that the data employed for statistical analysis depends on the type of host institution. The classification of institutions according to their level of complexity allowed for adequate interpretation of the previously published statistical data. Our interpretation of these studies suggests that the data on the percentage of malignant versus benign tumors and diversity of histological type must be obtained from series of low complexity institutions. LCI data are reliable whereas the HCI data are based on pre-selected cases, rendering the data unreliable.

Key words: *minor salivary gland tumours, palatal tumors, salivary glands tumours, tumors of palate.*

META-ANÁLISIS DE LA LITERATURA DE 1946 CASOS DE TUMORES DE GLÁNDULAS SALIVALES MENORES DE PALADAR

RESUMEN

Los tumores de glándulas salivales menores son relativamente poco comunes, tienen una gran diversidad en cuanto a su clasificación, aspecto histopatológico, sitio anatómico de localización y conducta clínica biológica.

Las series de cierta importancia mundial presentan resultados contradictorios, principalmente con respecto a la proporción de tumores benignos vs malignos y en relación a la frecuencia de los tipos histológicos. Siendo la localización palatina, en la mayoría de las series de tumores de glándulas salivales menores analizadas, la localización de mayor incidencia superando en la mayoría el 50% de los casos. El objetivo de nuestro estudio fue analizar mediante un meta-análisis, dos aspectos de los tumores de glándulas salivales menores de paladar, la proporción de tumores malignos vs tumores benignos, la frecuencia de los tipos histológicos en esta localización y el origen de la fuente estadística. Se realizó un meta-análisis de la literatura previamente seleccionada, de 29 series la literatura internacional de tumores de glándulas salivales menores, publicadas desde 1950 hasta 1999 incluyendo nuestra serie. Las instituciones de donde provienen las series, se clasificaron en A) Instituciones de alta complejidad (I.AC): Centros de referencia de cáncer y hospitales generales con tratamiento oncológico.B)Instituciones de intermedia complejidad (I.CI.); C) Instituciones de Baja Complejidad (IBC) A partir de las principales clasificaciones usadas, se realizó una simplificación y unificación de las clasificaciones que fue aplicada en la sumatoria de 1835 casos de la literatura y nuestra serie de 111 casos.

Los resultados del meta-análisis de la literatura, demostraron que los datos estadísticos de las series estudiadas, están en directa relación con el tipo de institución referente. La categorización de las instituciones según su complejidad permitió interpretar los datos estadísticos previamente publicados. Interpretamos que los porcentajes de tumores malignos vs benignos de paladar y la diversidad de tipo histológico debe ser obtenida a partir de series de I.BC, valores estadísticos que deberían tomarse como verdaderos. Los de I.AC tienen casos previamente seleccionados y nos son índices seguros de estas lesiones.

Palabras clave: *tumores de glándulas salivales menores, tumores palatinos, tumores de glándulas salivales, tumores de paladar.*

INTRODUCTION

Minor salivary gland tumors are rare and exhibit great diversity in terms of their histopathology, anatomical site, clinical-biological behavior and classification (1-4). Over the last 50 years numerous studies have been devoted to the study of case series of these tumors.

The studies of significant case series report contradictory data, mainly in terms of the proportion of benign versus malignant tumors (5, 6) and the frequency of histological types. Palate tumors are the most frequent, with an incidence of over 50% in most case series (5-34) (Table 1).

The aim of the present study was to perform a meta-analysis to evaluate salivary gland tumors of the palate in terms of the proportion of malignant versus benign tumors, the frequency of histological types and the data employed for statistical analysis. We studied 1835 cases of the literature in addition to our own series of 111 cases from the Faculty of Dentistry, University of Buenos Aires (unpublish data). The ultimate goal of the present study was to obtain reliable and accurate statistical data on incidence and aggressiveness of these lesions, usually initially diagnosed by non-specialist dentists.

MATERIALS AND METHODS

We performed a meta-analysis of pre-selected reports in the international literature (1950-1999) of

TABLE 1. Percentage of minor salivary gland tumors located in the palate

Year of publication	Authors	Nr. of tumors	Nr. of tumors	Mean: 52.2 % SD ± 12.3 %
		Minor salivary glands	Palate	% Tumors of the palate
1954	Smith AG (7)	32	17	53.1
1959	Brown RL (8)	38	15	39.4
1960	Fine G (9)	79	41	51.8
1960	Edwards EG (10)	23	14	60.8
1961	Chaudhry AP (11)	94	53	56.3
1962	Smith JF (12)	38	16	42
1966	Reynolds CT (13)	48	12	25
1966	Bardwil JM (14)	100	39	39
1967	Stuteville OH (15)	80	51	63.7
1968	Luna MA (16)	68	38	55.8
1969	Epker BN (17)	90	46	51.1
1969	Potdar GG (18)	110	59	53.6
1969	Bergman F (19)	46	22	47.8
1970	Crocker DJ (6)	38	17	44.7
1970	Frable WJ (20)	73	42	57.5
1973	Soskolne A (21)	64	42	65.6
1973	Spiro RH (5)	492	181	36.7
1984	Chaudhry AP (22)	189	82	43.3
1985	Regezi JA (23)	238	109	45.7
1985	Eveson (24)	336	183	54.4
1986	Chau MNY (25)	98	60	61.2
1988	Waldron ChA (26)	426	181	42.4
1991	van Heerden W (27)	70	58	82.8
1996	Rivera Bastidas H (28)	62	34	54.8
1997	Kusama, K (29)	129	77	59.6
1999	López MA (30)	196	128	65.3
2002	Jansisyanont P (31)	80	43	53.8
2005	Toida M (32)	82	64	78
2005	Yib WY (33)	213	102	47.8
2006	Jaber MA (34)	75	26	34.6

29 series of a total of 1835 cases of minor salivary gland tumors in addition to our own series of 111 cases (data will be published elsewere). For each series we recorded the year of publication, country of origin, type of host institution, total number of cases, number of cases of palatine tumors, number of benign and malignant tumors of the palate, and palatine histological types. Inclusion criteria were that the publications should include tables that allowed for the identification of palatine tumors and should include the necessary information to classify the host institution. The publications that failed to report the data separately were excluded from the study. The Institutions were classified in 3 groups: A) High Complexity Institutions (HCI): oncological reference centers and high complexity hospitals that treat cancer patients (e.g. Memorial Hospital for Cancer and Allied Disease, New York; M.D. Anderson Cancer Center and Tumor Institute, Houston, Texas; Henry Ford Hospital); B) Medium Complexity Institutions: general pathology laboratories of University Hospitals and/or Faculties of Medicine. Those series of mixed / heterogeneous origin were also included in this category; C) Low Complexity Institutions (LCI): Odontological Hospitals, Oral Biopsy laboratories at Faculties of Dentistry, Departments of Oral Pathology at Faculties of Medicine (e.g. Department of Oral Pathology, Free University Hospital, Division of Oral Pathology, College of Dentistry, Ohio). Patients usually attend LCI to have their first dental consultation.

The main problem involved in evaluating the parameter "histological type" was the variations in the classification of salivary gland tumors over the last 50 years (1, 2, 3, 4). Based on the main classifications employed, we simplified and unified the classifications to include all the cases of tumors of the palate under study.

RESULTS

For the sake of objectivity our results are presented in table form. The data have been grouped according to the level of complexity of the institutions for the following parameters: **1.** Proportion of benign versus malignant tumors (Table 2); **2.** Frequency of histological types for tumors of the palate (Table 3).

Statistical analysis

The test of proportions revealed statistically significant differences in the proportion of malignant tumors of the palate between institutions of different levels of complexity, i.e. HCI exhibited 59.5% and 97.1% more malignant tumors than MCI and LCI respectively ($p<0.0001$ for HCI versus MCI; $p<0.0001$ for HCI versus LCI (Tables 6 and 7).

DISCUSSION

The analysis of the literature on the main series of tumors of minor salivary glands in general and tumors of the palate in particular, revealed marked differences in the proportion of benign versus malignant tumors, to the extent that the series seemed to belong to different populations. The present study addressed this issue. The series of Spiro et al. (5) exhibited 22.7% of benign tumors of the palate whereas the series of Crocker et al. (6) exhibited 88.9% of benign tumors of the palate.

This analysis led us to undertake the present meta-analysis of the main series in the international literature. We performed a critical analysis to obtain statistical data that could contribute to explain these differences and obtain a true incidence value that the general dentist can use and trust.

Most of the series originated in USA (5-17, 20, 22, 23, 26, 35), Europe, Asia, Africa, Australia, Japan, Brazil and Venezuela (18-21, 24, 25, 27-30, 36, 37). The results reported in these studies were controversial, particularly in terms of the greater proportion (over 60%) of beningn tumors (6, 9, 12, 19-23, 25, 29, 35) versus the malignant tumors (5, 7, 14-17).

The analysis of the histological types was limited by the fact that the studies employed different histological classifications employed over the study period considered (1-4). We thus employed unification criteria to be able to perform a detailed analysis of the selected series (Table 4). The classification of the cases according to the level of complexity of the institutions proved particularly contributory.

Our results showed a clear trend. The proportion of benign versus malignant tumors was higher in the series originated in MCI (9-12, 20, 21, 24, 26, 35), even more so in the series originated in LCI (6, 19, 22, 23, 25, 27-29). Conversely, the series originated in HCI exhibited a high proportion of malignant tumors (5, 7, 13-17, 30) (Table 2).

Additional series that were evaluated revealed a similar trend, i.e. HCI series exhibited a higher proportion of malignant tumors of the palate (38, 39) whereas LCI series exhibited a higher proportion of benign tumors of the palate (40, 41, 42).

TABLE 2. Distribution of percentages of benign and malignant tumors of the palate according to the level of complexity of the host institution

High Complexity Institution series

Year	Authors	Country	Tumors Palate = 717	Benign tumors Palate	Mean: 32.7% SD ± 17 % % BT	Malignant tumors Palate	Mean: 67.3% SD ± 16.9 % %MT
1954	Smith AG et al. (7)	U.S.A	17	3	17.6	14	82.4
1966	Reynolds CT et al. (13)	U.S.A.	12	5	41.7	7	58.3
1966	Bardwil JM et al. (14)	U.S.A.	39	10	25.6	29	74.4
1967	Stuteville O et al. (15)	U.S.A.	51	2	3.9	49	96.1
1968	Luna MA et al. (16)	U.S.A.	38	9	23.7	29	76.3
1969	Epker BN et al. (17)	U.S.A.	46	17	37.0	29	63.0
1969	Potdar GG et al. (18)	India	59	35	59.9	24	40.7
1971	Eneroth CM (36)	Switzerland	185	98	53.0	87	47.0
1973	Spiro RH et al. (5)	U.S.A.	181	41	22.7	140	77.3
1999	Lopez MA et al. (30)	Brazil	128	54	42.2	74	57.8

Medium Complexity Institution series

Year	Authors	Country	Tumors Palate = 597	Benign tumors Palate	Mean: 59.6% SD ± 7.6 % % BT	Malignant tumors Palate	Mean: 40.3% SD ± 7.6 % %MT
1950	Rawson AJ et al. (35)	U.S.A.	9	6	66.7	3	33.3
1959	Brown R L et al. (8)	U.S.A.	15	7	46.7	8	53.3
1960	Fine G et al. (9)	U.S.A.	41	27	65.9	14	34.1
1960	Edwards EG (10)	U.S.A.	14	8	57.1	6	42.9
1961	Chaudhry AP et al. (11)	U.S.A.	53	27	50.9	26	49.1
1962	Smith JF (12)	U.S.A.	17	11	64.7	6	35.3
1970	Frable WJ et al. (20)	U.S.A.	42	27	64.3	15	35.7
1973	Soskolne A et al. (21)	Israel	42	29	69.0	13	31.0
1985	Eveson JW et al. (24)	England	183	97	53.0	86	47.0
1988	Waldron ChA et al. (26)	U.S.A.	181	105	58.0	76	42.0

Low Complexity Institution series

Year	Authors	Country	Tumors Palate = 632	Benign tumors Palate	Mean: 68 % SD ± 13.3 % % BT	Malignant tumors Palate	Mean: 31.9% SD ± 13.3 % %MT
1969	Bergman F (19)	Switzerland	22	19	86.4	3	13.6
1970	Crocker DJ et al. (6)	U.S.A.	18	16	88.9	2	11.1
1984	Chaudhry AP et al. (22)	U.S.A.	82	56	68.3	26	31.7
1985	Regezi JA et al. (23)	U.S.A.	109	70	64.2	39	35.8
1986	Chau MNY et al. (25)	Australia	60	40	66.7	20	33.3
1991	van Hereden W (27)	South Africa	58	31	53.4	27	46.6
1993	van Der wal JE et al. (37)	Germany	61	30	49.2	31	50.8
1996	Rivera Bastidas et al. (28)	Venezuela	34	19	55.9	15	44.1
1997	Kaoru Kusama et al. (29)	Japan	77	60	77.9	17	22.1
1999	Our series**	Argentina	111	77	69.3	34	30.6

**unpublish data.

Taken as a whole, minor salivary gland tumors exhibited a similar trend, i.e. HCI series showed a higher proportion of malignant tumors (5, 7, 13-18, 30, 31) whereas LCI and MCI showed a higher proportion of benign tumors (6, 10, 12, 19-26, 29, 32, 33, 41, 42, 54). We consider that the higher proportion of malignant minor salivary gland tumors of the palate in the series that originate in HCI are due to the fact that most of the patients have been referred by other institutions of a lower level of complexity to these

TABLE 3. Distributions of percentages of tumors of the palate according to the level of complexity of the host institutions and the histological type of tumor.

High Complexity Institution series

	Authors	PA	MA	MEC	ACC	Ad	MMT	A-CC	UC	EC
1954	Smith AG et al. (7)	3	0	8	1	4	0	0	1	0
1966	Reynolds CT et al. (13)	5	0	1	3	2	1	0	0	0
1966	Bardwil JM et al. * (14)									
1967	Stuteville OH et al. (15)	2	0	10	28	0	11	0	0	0
1968	Luna MA et al. (16)	9	0	5	17	2	5	0	0	0
1969	Epker Bruce N et al. (17)	12	5	5	16	0	0	1	0	0
1969	Potdar GG et al. (18)	35	0	4	13	7	0	0	0	0
1971	Eneroth CM (36)	98	0	30	44	7	3	2	1	0
1973	Spiro RH et al. (5)	41	0	21	65	47	7	0	0	0
1999	Lopez MA et al. * (30)									
		205	**5**	**84**	**187**	**69**	**27**	**3**	**2**	**0**

Medium Complexity Institution series

	Authors	PA	MA	MEC	ACC	Ad	MMT	A-CC	UC	EC
1950	Rawson AJ et al. (35)	6	0	0	2	1	0	0	0	0
1959	Brown RL et al. (8)	7	0	1	0	4	3	0	0	0
1960	Fine G et al. (9)	19	8	9	5	0	0	0	0	0
1960	Edwards EG (10)	8	0	1	1	1	3	0	0	0
1961	Chaudhry APet al. (11)	27	0	5	10	7	3	0	1	0
1962	Smith JF (12)	11	0	1	3	2	0	0	0	0
1970	Frable WJ et al. (20)	27	0	7	5	0	3	0	0	0
1973	Soskolne A et al. (21)	27	2	3	3	4	2	1	0	0
1985	Eveson et al. (24)	86	11	17	28	21	15	2	2	1
1988	Waldron ChA et al. (26)	94	11	18	19	32	4	3	0	0
		312	**32**	**62**	**76**	**72**	**33**	**6**	**3**	**1**

Low Complexity Institution series

	Authors	PA	MA	MEC	ACC	Ad	MMT	A-CC	UC	EC
1969	Bergman F (19)	19	0	1	1	0	1	0	0	0
1970	Crocker Dan J et al. (6)	14	2	0	1	1	0	0	0	0
1984	Chaudhry AP et al. (22)	56	0	13	10	0	3	0	0	0
1985	Regezi JA et al. (23)	66	4	23	16	0	0	0	0	0
1986	Chau MNY et al. (25)	36	4	11	5	3	1	0	0	0
1991	van Heerden W (27)	31	0	4	7	11	4	0	1	0
1993	van Der Wal JE et al. (37)	27	3	8	15	5	1	2	0	0
1996	Rivera Bastidas H et al.(28)	16	3	7	5	1	0	0	2	0
1997	Kaoru Kusama et al.(29)	59	1	7	7	2	0	0	1	0
2001	Our series**	72	5	15	13	6	0	0	0	0
		396	**22**	**89**	**80**	**29**	**10**	**2**	**4**	**0**

PA: Pleomorphic adenoma; MA: Monomorphic adenoma; MEC: Mucoepidermoid carcinoma; ACC: Adenoid cystic carcinoma; Ad: Adenocarcinoma; MMT: Malignant mixed tumor , A-CC: Acinic cell carcinoma , UC: Undifferentiated carcinoma; EC: Epidermoid carcinoma,

* The histological types were not considered for the analysis. ** unpublish data.

HCI that specialize in cancer therapy. Thus the HCI values would not reflect the true incidence of malignant tumors (Table 5).

The series that originate in LCI reflect a population with a high incidence of benign tumors.

The analysis of the frequency of the different histopathological types of tumors of the palate for each type of institution showed that Pleomorphic adenoma (PA) was the prevalent type among all bening tumours in all three types of institution, with

TABLE 4. Unified and simplified classification to study all the series.

1. Benign Epithelial Tumors:
- 1.1. Pleomorphic adenoma (PA)
- 1.2. Monomorphic adenomas (MA), all non-pleomorphic adenomas, with the exception of Warthin's tumor and Oncocytoma.
- 1.3. Warthin's tumor (WT).
- 1.4. Oncocytoma (O)

2. Malignant Epithelial Tumors:
- 2.1. Adenoid cystic carcinoma (ACC)
- 2.2. Mucoepidermoid carcinoma (MEC), always considered a malignant tumor.
- 2.3. Mixed malignant tumor or Carcinoma ex-Pleomorphic adenoma (MMT).
- 2.4. Acinic cell carcinoma (A-CC), always considered a malignant tumor.
- 2.5. Epidermoid carcinoma (EC), only salivary gland primary tumors.
- 2.6. Undifferentiated carcinoma (UC), considered as such.
- 2.7. Adenocarcinomas (Ad), includes all malignant varieties different of ACC, MEC, MMT, A-CC, EC, UC.

a frequency of 93.5%, 94.8% and 95.5% for HCI, MCI and LCI respectively.

The most frequent malignant neoplasm of the palate was the Adenoid cystic carcinoma (ACC), with a frequency of 48.5% in HCI series and 36.7% in MCI series. Mucoepidermoid carcinoma was the most frequent (44.3%) malignant neoplasm in LCI series. The frequency in our own series, classified as a LCI series, was 44.1%, in keeping with the mean value for the LCI series analyzed.

This difference would not be associated to racial or geographical differences given that the series corresponded to different geographical regions, i.e. USA (5-17, 20, 22, 23, 26, 35), Switzerland (19, 36), Australia (25), Germany (37), Venezuela (28), Brazil (30), Japan (29), Africa (27) and Argentina. Instead, the difference would be related to the clinical presentation of the tumor that is often misdiagnosed as a mucous cyst due to its benign appearance. Within this context, patients are frequently treated in LCI.

Adenocarcinomas of the palate were third in frequency in the series analyzed herein, i.e. 20.5% in HCI series, 24.9% in MCI series and 8.9% in LCI series. These data are particularly difficult to analyze due to the numerous variations the classifications have suffered in this aspect (1, 2, 3, 4). Tumor varieties which appear in recent papers as entities separated from Mucoepidermoid carcinoma (MEC), Adenoid cystic carcinoma (ACC), Undifferentiated carcinoma (UC), Epidermoid carcinoma (EC), Acinic cell carcinoma (A-CC) and Malignant mixed tumours (MMT) were grouped in this study under the general term of adenocarcinomas (Ad).

Renown past and recent studies conclude, based on statistical analysis of the data, that malignant neoplasms are more frequent in minor salivary glands (33, 44-48, 50-52). However, the present study suggests that this may not be the case. In the case of tumors of the palate, the proportion of benign tumors would be greater than that of malignant tumors as evidenced by the LCI series evaluated herein. The flawed interpretation would be due to variations in the incidence of malignant tumors associated to the type of Institution that originates the series. The detailed analysis presented herein of tumors of the palate in particular, and of minor salivary gland tumors in general also shows variations associated to the type of institution. HCI series exhibited a higher proportion of malignant tumors (Table 5) whereas MCI and LCI exhibited a higher proportion of benign tumors (Table 5).

We conclude that the present analysis of the literature on salivary gland tumors of the palate demonstrated that the statistical data corresponding to the series evaluated are associated to the type of Institution that originates the series. The classification of Institutions according to their level of complexity greatly contributed to the interpretation of previously published data.

Furthermore, the higher proportion of malignant tumors of the palate in HCI series is a finding with limited value. The higher incidence of benign tumors in LCI series would be the true, unbiased value, in keeping with our own LCI series. To a certain extent these findings resemble the data in the literature on ameloblastic transformation of odontogenic cysts.

TABLE 5. Distribution of percentages of benign and malignant minor salivary gland tumors according to the level of complexity of the host institution.

High Complexity Institution series

Year	Authors	Country	MSGT n=1296	BT n=278	Mean: 23.7%±11.9 % BT	Malig.tum. n=1018	Mean: 76.2%±7.6 % MT
1954	Smith AG et al. (7)	USA	32	8	25	24	75
1966	Reynolds C T et al. (13)	USA	48	10	20.8	38	79.1
1966	Bardwil J M et al. (14)	USA	100	13	13	87	87
1967	Stuteville O et al. (15)	USA	80	8	10	72	90
1968	Luna MA et al. (16)	USA	68	13	19.1	55	80.8
1969	Epker BN et al. (17)	USA	90	27	30	63	70
1969	Potdar GG et al. (18)	India	110	54	49.1	56	50.9
1973	Spiro RH et al. (5)	USA	492	58	11.7	434	88.2
1999	Lopez MA et al. (30)	Brazil	196	68	34.6	128	65.3
2002	Jansisyanont P (31)	USA	80	19	23.7	61	76.2

Medium Complexity Institution series

Year	Authors	Country	MSGT n=1174	BT n=660	Mean: 57%±9.9 % BT	Malig.tum. n=513	Mean: 45%±15.9 % MT
1959	Brown RL et al.(8)	USA	38	14	36.8	24	63.1
1960	Edwards E G (10)	USA	23	14	60.8	9	39.1
1961	Chaudhry AP et al. (11)	USA	94	43	45.7	51	54.2
1962	Smith JF (12)	USA	38	24	63.1	14	36.8
1970	Frable WJ et al. (20)	USA	73	42	57.5	31	42.4
1973	Soskolne A et al. (21)	Israel	64	43	67.1	21	32.8
1985	Eveson JW et al. (24)	England	336	180	54	155	46
1988	Waldron Ch A et al. (26)	USA	426	245	57.5	181	42.4
2005	Toida, M (32)	Japan	82	55	67	27	33

Low Complexity Institution Series

Year	Authors	Country	MSGT n=1739	BT n=1037	Mean: 60.4±11.1 % BT	Malig.tum. n=702	Mean: 39.5±11.1 % MT
1969	Bergman F (19)	Switzerland	46	40	87	6	13
1970	Crocker DJ et al. (6)	U.S.A.	38	26	68.4	12	31.5
1983	Isacsson G (41)	South Africa	201	145	72	56	28
1984	Chaudhry AP et al. (22)	U.S.A.	185	97	52.4	88	47.5
1985	Regezi J A et al.(23)	U.S.A.	238	150	63	88	37
1986	Chau MNY et al. (25)	Australia	98	61	62.2	37	37.7
1991	van Hereden W (27)	South Africa	70	34	48.5	36	51.4
1992	Rippin JW (42)	U.K.	194	106	54.6	88	45.3
1993	van Der wal J E et al. (37)	Germany	101	44	43.5	57	56.4
1995	Loyola AM (54)	Brazil	164	101	61.5	63	38.4
1996	Rivera Bastidas et al. (28)	Venezuela	62	34	54.8	28	45.1
1997	Kaoru Kusama et al. (29)	Japan	129	80	62	49	38
2005	Yib, WY (33)	USA	213	119	56	94	44

TABLE 6. Test of Proportions

Institution	Tumors of the palate	Proportion
HCI	n=717	0.67
MCI	n=597	0.42
LCI	n=632	0.34

TABLE 7. Significance

Institution	TVR	significance
HCI vs MCI	59.5 %	0.0001
MCI vs LCI	23.5 %	0.0039
LCI vs HCI	97.1%	0.0001

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