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Oral cancer incidence based on annual cancer statistics in Korea

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Abstract (J Korean Assoc Oral Maxillofac Surg 2012;38:20-8)

Introduction: The objective of this research was to determine the incidence of oral cancer in Korea.

Materials and Methods: The classifications of oral and maxillofacial cancer (OMFC) that we used are based on possible locations of OMFC: lip, tongue, mouth, salivary glands, tonsil, oropharynx, nasopharynx, hypopharynx, pharynx unspecified, and nose, sinuses.

Results: 1) There were 2,848 OMFC cases, accounting for 1.6% of all cancers. The male to female ratio was 2.72:1. 2) The estimated crude rates (CRs) were 5.7 overall, 8.4 for males, and 3.1 for females. The age-standardized incidence rates (ASRs) were 4.6 overall, 7.3 for males and 2.3 for females. 3) The incidence of mouth cancer was highest. The mouth and salivary glands were the most frequent sites for cancer among males and females, respectively. 4) Patients who were 40 years or older accounted for 91% of OMFC cases, with the highest proportion of cases in the 60-69 year-old age group for both sexes. 5) Tongue cancer was the most prevalent OMFC overall. Nasopharyngeal cancer was highest among males, and salivary gland cancer was highest among females. 6) From 2004 to 2008, the relative 5-year survival rate of OMFC patients was 57.5%. There was a trend of increasing survival among OMFC patients during the study period. The survival rate for females (69.3%) was much higher than that for males (53.1%).

Conclusion: Social and personal efforts should be required to increase the survival rates of OMFC patients and Korean national cancer management policy should establish new measures for economic and social management and support.

Key words: Age-standardized incidence rates, Estimated crude rate, Oral and maxillofacial cancer, Oral cancer incidence, Relative 5-year survival rate

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I. Introduction

According to the "2010 Social Indicators in Korea" announced by the National Statistical Office, Korea was already an aging society in 2000 with the aged accounting for 7% of the general population. By 2018 the aged will make up 14.3% of the Korean population, and by 2026 Korea will be considered a super-aged society with the aged constituting over 20% of the population[1]. In addition, the incidences of chronic diseases have increased, as has interest in healthy lifestyles. Statistics on cancer, the number one cause of mortality, are considered especially important to compile[2]. The Korean government has been asked to devise and enforce comprehensive policies for cancer. Accurate statistics are necessary to establish optimal cancer management policies.

The Central Cancer Registry Project was started in 1980 in various hospitals based on the National Medical Center. In 2000, the Central Cancer Registry Project headquarters were transferred to the newly founded National Cancer Center. The Korean government enacted a cancer management law in 2003, and established the National Cancer Center along with local units in 2004 to implement a nationwide population-based cancer registry project[3].

To improve the overall reliability of cancer incidence data, the National Cancer Center conducts statistical surveys on cancer incidence among unregistered individuals who are suspected of having cancer based on National Health Insurance data and has established a national cancer incidence database by incorporating data from all of the cancer registry projects conducted in Korea. The National Cancer Center also

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supports the cancer registry projects of clinical academies and research councils to calculate accurate survival rates for each stage of each cancer type. As a result, the national cancer registry project has published an annual report since 2005 based on national cancer incidence statistics, and the scope of the announcements has been expanded to include statistics for cancer survival in 2008 and statistics for cancer prevalence in 2009[3].

However, the data for cancer incidence as presented by annual reports of the national cancer registry project were based on patients who were diagnosed with cancer between January 1 and December 31 2008, but also included cancer patients registered until November 2009. Therefore, statistics for cancer incidence may differ based on the time of announcement, and there is overlap among patients with multiple cancers in the calculations. Despite these shortcomings, the collection, management, analysis, and accurate presentation of statistics is important for national cancer management and research[3]. Nonetheless, oral and maxillofacial cancers (OMFCs) have attracted less attention from the Korean government than other cancers because they have high incidence rates in developing countries, but low incidence rates relative to the overall cancer incidence rate in most advanced countries[4]. In 2009, however, 3.1 males and 0.9 females per 100,000 people died of oral cancer, and the number of oral cancer patients is increasing[2]. In America, 30,000 cases of oral cancers develop and 7,000 people die of oral cancer annually[5]. Therefore, in the present clinical statistical analysis, we divided and sorted OMFCs based on the national cancer registry statistics from 2008[3].

OMFCs were divided into 10 areas: lip, tongue, mouth, salivary glands, tonsil, oropharynx, nasopharynx, hypopharynx, pharynx unspecified, nose and sinuses. These are areas treated by head and neck surgery. Melanoma around the mouth was not included in this classification. We conducted this research to obtain necessary data to establish cancer management policies for OMFCs, to develop early diagnosis and treatment plans for oral cancers, to improve survival rates, and to help define the direction and scope of diagnosis by oral and maxillofacial surgeons.

II. Materials and Methods

We divided and sorted cancers in the oral and maxillofacial area based on data from the annual national cancer registry report for 2008. The incidence rates for each OMFC were divided into 10 OMFC types among a total of 61 cancers based on the C15 standard of the 9th edition of Cancer Incidence in Five Continents published in 2007 by the International Agency for Research on Cancer[3]. When divided into 24 categories based on major cancers, malignant neoplasms in the lip, mouth, and pharynx were classified as C00-C14. In the 24-cancer classification, C30-C31 cancers (nasal cavity and paranasal sinuses in the oral and maxillofacial area) were excluded.

Cancers in the oral and maxillofacial area were divided into 15 areas and subsequently incorporated into 10 areas. Malignant neoplasms of the base of the tongue (C1) and other

Table 1. Classifications of oral and maxillofacial cancer

ICD-10		Abbreviation
C00	Malignant neoplasm of lip	Lip
C01-C02	Malignant neoplasm of base of tongue	Tongue
	Malignant neoplasm of other and unspecified parts of the tongue	
C03-C06	Malignant neoplasm of gum	Mouth
	Malignant neoplasm of floor of mouth	
	Malignant neoplasm of palate	
	Malignant neoplasm of other and unspecified parts of the mouth	
C07-C08	Malignant neoplasm of parotid gland	Salivary glands
	Malignant neoplasm of other and unspecified major salivary glands	
C09	Malignant neoplasm of tonsil	Tonsil
C10	Malignant neoplasm of oropharynx	Oropharynx
C11	Malignant neoplasm of nasopharynx	Nasopharynx
C12-C13	Malignant neoplasm of pyriform sinus	Hypopharynx
	Malignant neoplasm of hypopharynx	
C14	Malignant neoplasm of other and ill-defined sites in the lip, oral cavity, and pharynx	Pharynx unspecified
C30-C31	Malignant neoplasm of nasal cavity and middle ear	Nose and sinuses
	Malignant neoplasm of accessory sinuses	

(ICD-10: International Classification of Diseases for Oncology)

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and unspecified parts of the tongue (C2) were categorized as tongue cancer; malignant neoplasms of the gums (C3), floor of the mouth (C4), palate (C5), and other and unspecified parts of the mouth (C6) were categorized as mouth cancer. Malignant neoplasms of the parotid gland (C7) and other and unspecified parts of the salivary glands (C8) were categorized as salivary gland cancer; malignant neoplasms of the pyriform sinus (C12) and hypopharynx (C13) were categorized as hypopharyngeal cancer, and malignant neoplasms of the nasal cavity and middle ear (C30) and accessory sinuses (C31) were categorized as cancers of the nose, and sinuses.(Table 1)

In this study, the estimated crude rate (CR) of each cancer was calculated by dividing the total population by the number of cancer patients occurring in a specific group during the research period. The estimated CRs are expressed per 100,000 people. The age-standardized incidence rate (ASR) is a weighted average rate calculated by applying the rate of the standard population to each age group as a weighted value. The ASR is used to compare cancer incidence rates in locations or during periods with different age compositions and is expressed as the rate per 100,000 people after revision based on the mid-year registered population in 2000. Annual percent change (APC) is an index that summarizes the trend of cancer incidence and is calculated by applying the exponential function to the incline of the linear trend curve of the log-applied annual ASR. The APC is interpreted as the annual average percent change of cancer incidence rate. The 5-year prevalence indicates the number of cancer patients surviving for 5 years, starting on January 1 the year after the standard year.

III. Results

1. Incidence rates of OMFCs

In 2008, a total of 178,816 patients were newly diagnosed with cancer in Korea. Patients with OMFC numbered 2,848, making up 1.6% of all Korean cancer patients. Compared with 165,942 patients in 2007, the total number of cancer patients increased by 7.8%, and the number of OMFC patients increased by 9.1% from 2,610 in 2007. The CR of OMFC was estimated to be 5.7 per 100,000 people, with an ASR of 4.6 per 100,000 people after revision based on the mid-year registered population in 2000.

The CR and ASR for all cancers were 361.9 and 286.8, respectively. The most common cancer in Korea in 2008 was stomach cancer, followed by thyroid cancer, colorectal cancer, lung cancer, liver cancer, breast cancer, and prostate cancer. The most common type of OMFC was mouth cancer, followed by tongue cancer, nasopharyngeal cancer, salivary gland cancer, and hypopharyngeal cancer.(Table 2)

1) Cancer incidence according to sex

In total, there were 93,017 male cancer patients and 85,799 female cancer patients in Korea; the male to female ratio was 1.08 : 1. Total CR was 361.9 per 100,000 people; the male CR was 375.7 and female CR was 348.1. The total ASR was 286.8, male ASR was 327.1, and female ASR was 269.1. There were 2,082 male OMFC patients and 766 female patients; the male to female ratio was 2.72 : 1. The CR was 8.4 per 100,000 people for males and 3.1 for females. The ASR was 7.3 for males and 2.3 for females. The most common

Table 2. Numbers of oral and maxillofacial cancer cases and rates according to primary site and sex

Site	Cases (%)			CR			ASR		
All cancers	Total	Male	Female	Total	Male	Female	Total	Male	Female
	178,816	93,017	85,799	361.9	375.7	348.1	286.8	327.1	269.1
Lip	37 (0.0)	23 (0.0)	21 (0.0)	0.1	0.1	0.1	0.1	0.1	0.1
Tongue	456 (0.3)	315 (0.3)	141 (0.2)	0.9	1.3	0.6	0.7	1.1	0.4
Mouth	492 (0.3)	339 (0.4)	152 (0.2)	1.0	1.4	0.6	0.8	1.2	0.4
Salivary glands	370 (0.2)	211 (0.2)	159 (0.2)	0.7	0.9	0.6	0.6	0.8	0.5
Tonsil	298 (0.2)	266 (0.3)	32 (0.0)	0.6	1.1	0.1	0.5	0.9	0.1
Oropharynx	73 (0.0)	62 (0.1)	11 (0.0)	0.1	0.3	0.0	0.1	0.2	0.0
Nasopharynx	434 (0.2)	325 (0.3)	109 (0.1)	0.9	1.3	0.4	0.7	1.1	0.4
Hypopharynx	353 (0.2)	329 (0.4)	24 (0.0)	0.7	1.3	0.1	0.5	1.1	0.1
Pharynx unspecified	37 (0.0)	29 (0.0)	8 (0.0)	0.1	0.1	0.0	0.1	0.1	0.0
Noseand sinuses	291 (0.2)	183 (0.2)	108 (0.1)	0.6	0.7	0.4	0.5	0.7	0.3
Oral and maxillofacial cancers	2,848 (1.6)	2,082 (2.2)	766 (0.9)	5.7	8.4	3.1	4.6	7.3	2.3

(CR: estimated crude rate, ASR: age-standardized incidence rate)
Values are number of cases (%) or rate per 100,000.
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cancer among males was stomach cancer and among females was thyroid cancer. The most common type of OMFC among males was mouth cancer followed by hypopharyngeal cancer, nasopharyngeal cancer, and tongue cancer, making up 2/3 of the total OMFCs among males. For females, the most common type of OMFC was salivary gland cancer followed by mouth cancer, tongue cancer, and nasopharyngeal cancer, accounting for 3/4 of the overall OMFCs among females. (Table 2)

2) Cancer incidence according to age group

The most common cancer in the 0-14 age group was leukemia for both sexes, and thyroid cancer in the 15-34 age group. In the 35-64 age group, the most common cancer among males was stomach cancer and among females was thyroid cancer. In the 65+ age group, the most common cancer among males was lung cancer and among females was colorectal cancer. A total of 91% of overall OMFCs developed in patients aged 40 years and over, with the

Table 3. Major primary sites of oral and maxillofacial cancer for the 0-39 age group

	1st	2nd	3rd
Both sexes (cases)	Salivary glands (80)	Nasopharynx (61)	Tongue (46)
Male (cases)	Nasopharynx (46)	Salivary glands (41)	Tongue (25)
Female (cases)	Salivary glands (39)	Tongue (21)	Nasopharynx (15)

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Table 4. Major primary sites of oral and maxillofacial cancer for the 40-49 age group

	1st	2nd	3rd
Both sexes (cases)	Nasopharynx (111)	Salivary glands (70)	Tonsil (66)
Male (cases)	Nasopharynx (85)	Tonsil (54)	Tongue, salivary glands (45)
Female (cases)	Salivary glands (35)	Mouth (27)	Nasopharynx (26)

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Table 5. Major primary sites of oral and maxillofacial cancer for the 50-59 age group

	1st	2nd	3rd
Both sexes (cases)	Nasopharynx (122)	Tongue (116)	Mouth (106)
Male (cases)	Tonsil (95)	Nasopharynx (89)	Tongue (87)
Female (cases)	Nasopharynx (33)	Tongue (29)	Salivary glands (27)

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Table 6. Major primary sites of oral and maxillofacial cancer for the 60-69 age group

	1st	2nd	3rd
Both sexes (cases)	Mouth (138)	Hypopharynx (128)	Tongue (121)
Male (cases)	Hypopharynx (122)	Mouth (110)	Tongue (86)
Female (cases)	Tongue (35)	Salivary glands (33)	Mouth (28)

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Table 7. Major primary sites of oral and maxillofacial cancer for the 70-79 age group

	1st	2nd	3rd
Both sexes (cases)	Mouth (127)	Hypopharynx (101)	Tongue (86)
Male (cases)	Hypopharynx (98)	Mouth (91)	Tongue (57)
Female (cases)	Mouth (36)	Tongue (29)	Salivary glands, nose and sinuses (21)

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Table 8. Major primary sites of oral and maxillofacial cancer for the 80+ age group

	1st	2nd	3rd
Both sexes (cases)	Mouth (39)	Hypopharynx (28)	Tongue (26)
Male (cases)	Hypopharynx (24)	Mouth (16)	Tongue (15)
Female (cases)	Mouth (23)	Nose and sinuses (16)	Salivary glands (14)

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highest proportion in the 60-69 age group for both sexes. The most common cancer in the age group of 39 and younger was salivary gland cancer, with nasopharyngeal cancer being the most common cancer among males and salivary gland cancer being most common among females.(Table 3) In the 40-49 age group, the most common cancer was nasopharyngeal cancer; for males, it was nasopharyngeal cancer, and for females, salivary gland.(Table 4) In the 50-59 age group, the most common cancer was nasopharyngeal cancer; the most common cancer was tonsil cancer among males and nasopharyngeal cancer among females.(Table 5) In the 60-69 age group, the most common cancer was mouth cancer; males were most commonly afflicted by hypopharyngeal cancer, and females were most commonly afflicted by tongue cancer.(Table 6) Finally, in the 70+ age group, the most common cancer was mouth cancer; the most common cancer was hypopharyngeal cancer among males and mouth cancer among females.(Tables 7, 8)

3) Trends in major cancers by year and sex

The total number of cancer patients in Korea increased 77% from 101,032 in 1999 to 178,816 in 2008. The increase in cancer incidence was greater in females than in males. Male APC was 1.5, but female APC was 5.3. The trends in the numbers of patients with malignant neoplasms of the lip, mouth, and pharynx (C00-C14), except for cancers of the nose and sinuses (C30-C31), as well as CR and ASR during the period 1999-2008 (Table 9), suggests that the number of patients increased 49% from 1,716 in 1999 to 2,557 in 2008. The number of male patients increased from 1,294 to 1,899, and the number of female patients increased from 422 to 658; male APC was -0.3, and female APC was 0.5. The increase in incidence of OMFC was greater among females than males.

The trends in OMFC during the period 2002-2008 (Table 10) indicate that the incidence rates of salivary gland and hypopharyngeal cancer were increased. However, the proportion of OMFCs relative to all cancers was on the decline. While the trend in most common cancers in male

Table 9. Trends and incidence of oral and maxillofacial cancer in both sexes and among males and females during the period 1999-2008

	Year														
	1999			2000			2001			2002			2003		
	Cases	CR	ASR	Cases	CR	ASR	Cases	CR	ASR	Cases	CR	ASR	Cases	CR	ASR
Both	1,716	3.6	3.7	2,183	4.6	4.6	1,830	3.8	3.7	1,941	4.0	3.8	2,069	4.3	3.9
Male	1,294	5.5	6.3	1,476	6.2	7.3	1,359	5.7	6.2	1,455	6.0	6.4	1,570	6.5	6.7
Female	422	1.8	1.7	707	3.0	2.6	471	2.0	1.8	486	2.0	1.8	499	2.1	1.8
	Year														
	2004			2005			2006			2007			2008		
	Cases	CR	ASR	Cases	CR	ASR	Cases	CR	ASR	Cases	CR	ASR	Cases	CR	ASR
Both	2,136	4.4	3.9	2,209	4.5	3.9	2,277	4.7	3.9	2,406	4.9	4.0	2,557	5.2	4.1
Male	1,564	6.4	6.3	1,598	6.5	6.2	1,678	6.8	6.3	1,777	7.2	6.5	1,899	7.7	6.5
Female	572	2.4	2.0	611	2.5	2.1	599	2.5	2.0	629	2.6	2.0	658	2.7	2.0

(CR: estimated crude rate, ASR: age-standardized incidence rate)

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Table 10. Trends and incidence of oral and maxillofacial cancer in both sexes during the period 2002-2008

	2002	2003	2004	2005	2006	2007	2008
Lip	36	44	39	29	38	33	44
Tongue	334	331	411	414	434	486	456
Mouth	387	371	396	413	402	415	492
Salivary glands	230	273	273	343	313	322	370
Tonsil	253	195	224	198	249	245	298
Oropharynx	66	96	66	72	60	80	73
Nasopharynx	320	345	313	323	375	359	434
Hypopharynx	270	346	317	331	347	341	353
Pharynx unspecified	43	34	29	28	45	31	37
Nose and sinuses	294	257	307	260	280	298	291
Total	2,223	2,326	2,443	2,469	2,557	2,704	2,848
Oral and maxillofacial cancer/all cancers	1.9	1.9	1.8	1.7	1.7	1.6	1.6

Values are number of cases or %.

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patients in 2008 did not change much compared to the trend in 2002 (Table 11), the incidence of salivary gland cancer among females increased.(Table 12)

4) Comparison of cancer incidence by region

The region with the highest ASR of OMFC was Jeju-do followed by Seoul and Gangwon-do. For males, the region with the highest ASR was Jeju-do followed by Seoul and Jeollanam-do; for females, however, the region with the highest ASR was Gyeongsangnam-do followed by Gyeonggi-do and Chungcheongnam-do.(Table 13)

2. Prevalence of OMFC

In 2008, the most common cancer in Korea was stomach cancer, accounting for 17.4% of the total cancer patients, followed by thyroid cancer, colorectal cancer, breast cancer, liver cancer, and lung cancer. OMFCs among males were 10th most common. The most common type of OMFC was tongue cancer, followed by nasopharyngeal cancer, mouth cancer, salivary gland cancer, and tonsil cancer. Among males, the most common type of OMFC was nasopharyngeal cancer, followed by tongue cancer and mouth cancer. For females, however, the most common cancer was salivary

Table 11. Trends and incidence of oral and maxillofacial cancer among males during the period 2002-2008

	2002	2003	2004	2005	2006	2007	2008
Lip	21	26	28	16	31	20	23
Tongue	233	226	278	269	284	340	315
Mouth	267	271	265	282	273	277	339
Salivary glands	134	157	145	194	193	175	211
Tonsil	187	169	193	165	207	211	266
Oropharynx	62	86	60	63	52	76	62
Nasopharynx	236	258	242	237	271	259	325
Hypopharynx	255	326	289	308	323	327	329
Pharynx unspecified	36	30	18	24	37	27	29
Nose and sinuses	184	165	189	169	167	179	183
Total	1,615	1,735	1,753	1,767	1,845	1,956	2,082
Oral and maxillofacial cancer/all cancers	2.5	2.5	2.4	2.2	2.2	2.2	2.2

Values are number of cases or %.

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Table 12. Trends and incidence of oral and maxillofacial cancer among females during the period 2002-2008

	2002	2003	2004	2005	2006	2007	2008
Lip	15	18	11	13	7	13	21
Tongue	101	105	133	145	150	146	141
Mouth	120	100	131	131	129	138	153
Salivary glands	96	116	128	149	120	147	159
Tonsil	66	26	31	33	42	34	32
Oropharynx	4	10	6	9	8	4	11
Nasopharynx	84	87	71	86	104	100	109
Hypopharynx	15	20	28	23	24	14	24
Pharynx unspecified	7	4	11	4	8	4	8
Nose and sinuses	110	92	118	91	113	119	108
Total	608	591	690	702	712	748	766
Oral and maxillofacial cancer/all cancers	1.2	1.1	1.1	1.1	1.0	1.0	0.9

Values are number of cases or %.

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Table 13. Comparison of age-standardized rates of oral and maxillofacial cancer according to regions in Korea

	1st	2nd	3rd	4th	5th
Total (4.1)	Jeju-do (5.5)	Seoul, Gangwon-do (4.5)		Gyeongsangbuk-do (4.4)	Jeollanam-do, Busan (4.3)
Male (6.5)	Jeju-do (9.9)	Seoul (7.5)	Jeollanam-do (7.4)	Gyeongsangbuk-do (7.2)	Gangwon-do, Chungcheongbuk-do (7.1)
Female (2.0)	Gyeongsangnam-do (2.4)	Gyeonggi-do, Chungcheongnam-do (2.3)		Daegu, Gyeongsangbuk-do (2.2)	

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gland cancer followed by tongue cancer and mouth cancer. (Table 14)

3. Survival rates of OMFC

The 5-year survival rate of OMFC in Korea during 1993-2008, excluding cancer of the nose and sinuses (C30-C31), was 50.8%. The male survival rate was 45.6%, and that of females was 65.6%, which was not that different from the survival rate for all cancers.(Table 15) Moreover, the relative 5-year survival rate of OMFCs during the period 2004-2008 was 57.5%, which encompassed an increase from 41.1% during the period of 1993-1995 to 46.7% during the period 1996-2000 and 53.7% during the period 2001-2005. Currently, more than half of all OMFC patients survive for more than 5 years. However, there was a great difference between the sexes during the period 2004-2008, with rates of 53.1% for males and 69.3% for females.(Table 16)

Table 14. Five-year prevalence ratesof oral and maxillofacial cancer by sex, 2008

Site	Cases (%)			CR			ASR		
All cancers	Total	Male	Female	Total	Male	Female	Total	Male	Female
	507,390	240,182	267,208	1,027.0	970.2	1,084.1	821.0	841.2	852.0
Lip	162 (0.0)	105 (0.0)	57 (0.0)	0.2	0.4	0.2	0.1	0.4	0.1
Tongue	1,448 (0.3)	936 (0.4)	512 (0.2)	2.9	3.8	2.1	2.3	3.2	1.6
Mouth	1,359 (0.3)	871 (0.4)	488 (0.2)	2.8	3.5	2.0	2.2	3.1	1.5
Salivary glands	1,347 (0.2)	730 (0.3)	617 (0.2)	2.7	2.9	2.5	2.3	2.6	2.1
Tonsil	930 (0.2)	785 (0.3)	145 (0.1)	1.9	3.2	0.6	1.5	2.6	0.4
Oropharynx	162 (0.0)	139 (0.1)	23 (0.0)	0.1	0.6	0.1	0.1	0.5	0.1
Nasopharynx	1,364 (0.3)	987 (0.4)	377 (0.1)	2.8	4.0	1.5	2.3	3.4	1.2
Hypopharynx	769 (0.2)	717 (0.3)	52 (0.0)	1.6	2.9	0.2	1.2	2.5	0.2
Pharynx unspecified	69 (0.0)	53 (0.0)	16 (0.0)	0.1	0.2	0.1	0.1	0.2	0.1
Nose and sinuses	899 (0.2)	546 (0.2)	353 (0.1)	1.8	2.2	1.4	1.5	1.9	1.1
Oral and maxillofacial cancers	8,509 (1.7)	5,869 (2.4)	2,640 (1.0)	17.2	23.7	10.7	13.8	20.2	8.3

(CR: estimated crude rate, ASR: age-standardized incidence rate)
Values are number of cases (%) or rate per 100,000.
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Table 15. Relative survival rates of oral and maxillofacial cancer patients by sex during the period 1993-2008

	Sex	Cases	Relative survival rate				
			1st year	2nd year	3rd year	4th year	5th year
C00-C14	Total	26,282	77.0	63.0	56.7	53.3	50.8
	Male	19,614	74.3	58.8	52.0	48.3	45.6
	Female	6,668	84.8	75.1	70.3	67.6	65.6
All cancer	Total	1,623,046	70.7	61.2	56.5	53.6	51.7
	Male	890,584	64.1	53.0	47.8	44.7	42.7
	Female	732,462	78.5	70.9	66.8	64.2	62.3

Values are number of cases or %.
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Table 16. Trends in the relative survival rates of oral and maxillofacial cancer patients by sex during the period 1993-2008

	Sex	1993-1995		1996-2000		2001-2005		2004-2008	
		Cases	5-year survival	Cases	5-year survival	Cases	5-year survival	Cases	5-year survival
C00-C14	Total	3,400	41.1	7,484	46.7	9,219	53.7	10,167	57.5
	Male	2,598	35.8	5,672	41.1	6,829	48.9	7,450	53.1
	Female	802	58.1	1,812	63.8	2,390	67.3	2,717	69.3
All cancer	Total	169,365	41.2	405,945	44.0	583,485	53.4	712,287	59.5
	Male	96,191	31.7	230,866	35.3	321,031	44.9	377,654	50.8
	Female	73,174	53.4	175,079	55.3	262,454	63.5	334,633	69.2

Values are number of cases or %.
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IV. Discussion

Malignant melanoma around the mouth was excluded from the present analyses. Although it is assumed to be included in category C43 (malignant melanoma on skin), it is difficult to classify precisely because it is not explicitly included in the annual reports that we used for references. Moreover, the sums of CR and ASR were sorted into one category (C00-C014) in the annual reports, but we recorded it by adding figures in C30-C31 to the existing figures. In addition, cancer patients may have been assigned to regions different from those where they actually lived the longest because they were categorized based on current addresses. Therefore, the interpretations of incidence rates per region may be inaccurate.

The incidence rates of oral cancer differ by race, region, and other conditions[6,7]. In this analysis, the incidence of OMFC in Korea was 1.6%. As a comparison, nearly 50,000 people in Europe developed oral cancer in 1995 to account for 2% of the total cancer incidence rate[8], which is similar to the result obtained in this study. With respect to the incidence rate by sex, Funk et al.[9] found that for oral cancer patients in America, male patients outnumbered female patients at a ratio of 60 : 40. Moreover, Abreu et al.[10] found that male patients outnumbered female patients at a ratio of 2.4 : 1 in Australia. In Korea, Kim et al.[11] reported that there were more male oral cancer patients than female patients. According to Cho et al.[12], there were 2.7 times more male Korean oral cancer patients than female patients. In this analysis, the ratio between males and females was 2.72 : 1. With respect to age group, the 60-69 age group exhibited the highest incidence in both sexes. Chandu et al.[13] reported the average age to be 62.6, with 61.1 for males and 64.5 for females. According to Funk et al.[9], the average age was 64. However, the incidence rate of cancer tended to decrease among people aged 80 and over. This may not indicate that the actual cancer incidence rate is low in older age patients; rather, the cancer incidence rate appears to be lower than the actual rate because medical institutions higher than the hospital level do not frequently diagnose people in that age group as cancer patients.

The most common OMFC was mouth cancer, followed by tongue cancer and nasopharyngeal cancer. With respect to 5-year prevalence, the most common cancer was tongue cancer followed by nasopharyngeal cancer and mouth cancer, with differences by region and population origin. Warnakulasuriya[14] and Zini et al.[15] reported that the most common cancer was lip cancer, which is very different from results from the domestic reports. In particular, the incidence rate of salivary gland cancer increased among females and younger people. Bjørndal et al.[16], reported that the average age of patients was slightly different, but the ASR of salivary gland cancer was 0.8, which is similar to that reported in domestic research studies. In this analysis, the 5-year survival rate of cancer was 57.5%, while Cho et al.[12] reported 57.63%, Layland et al.[17] reported 44.6%, and Chandu et al.[13] reported 83.3%. The continuous increase in cancer incidence is caused by increases in the number of elderly people, development of cancer diagnosis technology, popularization of early diagnosis, and westernization of eating habits. Drinking and smoking are the major causes of OMFC because, although rates of drinking and smoking have decreased worldwide since 2006, the incidence of drinking and smoking is highest among Organization for Economic Co-operation and Development member countries[1]. Many reports indicate that smoking combined with drinking significantly increases the possibility of oral cancer[18,19]. Further, oral status, chewing tobacco, working environment, viral infection, weakened immune system, and stress may also cause oral cancer[20,21]. Increases in cancer survival rates in both sexes may be due to improvements in cancer diagnosis and treatment technologies, and improvements at the level of the national cancer management project.

V. Conclusion

Social and personal efforts may be required to increase the survival rates of OMFC patients, including early detection and diagnosis of oral cancer, regular diagnosis, and education to improve patient lifestyles, specifically with respect to smoking and drinking. The increases in cancer incidence and survival rate lead to increases in the number of cancer patients. Therefore, Korean national cancer management policy should establish new measures for economic and social management and support for surviving cancer patients. Finally, oral and maxillofacial surgeons should continually work to develop anticancer treatments, radiotherapy, and oral cancer surgeries, while also participating in gene therapy[22], radiation surgery such as cyber knife techniques[23], and immunohistochemical research.

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