

RESEARCH ARTICLE



Kissing, Saliva and Human Papilloma Virus: Principles, Practices, and Prophylaxis

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Abstract

Introduction: Kissing is a globally practiced form of communication, yet saliva is often deemed a harmless bodily fluid. Many viruses thrive in salivary and oro-pharyngeal lymphoid cells. These viruses include Human Papilloma Virus (HPV), Human Herpes Viruses, Epstein – Barr, HIV, Polio and others, and are transmitted between people when kissing.

Aim: This appraisal (1) assesses socially sanctioned kissing habits, (2) examines the presence of Human Papilloma Virus [HPV] in saliva and salivary tests for HPV, (3) reviews protection from HPV vaccines, (4) deconstructs attitudes and behavior, and critiques the oncogenic potential of HPV morbidity from peri-osculation practices.

Materials and Methods: Clinical- tests for putative HPV viruses in oro-pharyngeal cancers use saliva to detect HPV oncogenic types; these re-affirm presence of HPV's in saliva, and their causal relationship to the majority of head and neck cancers.

Conclusion: Although frequency of new infections from kissing is unknown, this critique suggests caution against random kissing, encourages use of HPV vaccination for prophylaxis, and indicates that this may moderate HPV and viral transmission, with consequent reduction of HPV morbidity and mortality.

Abbreviations used in this article: HPV= Human Papilloma Virus; COF= Collected oral fluids comprising mixed saliva from major and minor salivary glands, exfoliated cells, oral epithelial mucoidal cellular secretions, and pharyngeal extruded liquids. HIV= Human Immunodeficiency Virus ; OPSCC= Oral squamous cell carcinoma; HNC= Head and Neck cancer; LGBTQ2 = Lesbian, gay, bisexual, trans, queer two spirited;

Keywords: Cancer, human papilloma virus (HPV), kissing, oncogenesis, oro-pharynx, prophylaxis, saliva, tests, vaccination.

1 | INTRODUCTION

For millennia, all forms of kissing were practiced in different cultures. Consequently kissing was venerated by painters, sculptors, scribes, and poets. Kissing oscillated between the divine and profane, as lyrics waxed wonderfully in songs, sonnets and emotions as part of the bouquets of love. Antique documents chronicle the practice, and certainly kissing was most practiced widely during Roman times. Kissing spread throughout the ancient Roman Empire as Latin culture engulfed Italy and subsequently dominated Europe, North Africa and The Middle East for the next 1500 years. Kissing was a central focus for the 17th Century Latin German tome ‘*Opus Polyhistoricum... de Osculis*’, by Martin von Kempe (1). Kempe claimed there were over 20 kissing types, but for current (2020) pragmatic purposes, only six different types survive, and retain Latin nomenclature. (2) The various types are:-

1. Gesture
2. Cultural
3. Osculum
4. Basium
5. Saviolum
6. Oro-genital

Gesture kissing: Two types exist : (1) **Air-Kissing:** An approximation of cheek to cheek avoiding any contact; it should be less than 5.5cms, and with air between. Heat and olfactory (as pheromones) may be sensed. For hygiene *Air Gesture Kissing* is successful to avoid microbe transfer. (2) **Hand-and-Foot kissing**, also deemed to be gesture kissing, allows lips-to-corporal-skin contact, but minimally reduces bacterial transfer. Without hand hygiene frequent manual touching (shaking hands and hand kissing) is a health hazard. Although an ancient custom, this is often cited as causing spread of antibiotic resistant infections (*Methicillin Resistant Staphylococcus-MRS*, & *Clostridium difficile*). Disinfecting hands with detergent soaps, gels or alcohol, is now common in hospitals. (3)

Cultural kissing: Involves facial contact other than lips, any facial or skin contact is regarded as cultural kissing.. Well-known (Inuit Eskimo) is rub-

bing noses. Among some primitive Indonesian and African tribes gentle frontal cranial contact-tapping is practiced to indicate friendly greeting and respect.

Osculum: This is a peck with closed lips on the recipients’ cheek. This may be regarded with also as part of gesture kissing, and is often repeated onto both sides of the face, between mutual recipients. Some cultures (Russian, Arabian) repeat this more than once with greetings or farewells.

Basium: This is done without mouth opening, but with mutual touching of lips. Slight pressure is maintained for seconds. Sustaining a *Basium* for longer is satisfying for some.

Saviolum: An approximation of lips, and opening the mouth with lingual-intrusion into a partners’ mouth. **Saviolum** is known in Anglo-Saxon cultures as ‘French kissing’. Each participant mutually alternates inserting their tongue into the partners’ oral cavity, while sustaining lip-to-lip contact. **Saviolum** is regarded as the most passionate kiss, and derogatorily described as “a Tonsil-Washer”. This type of wet kissing involves a subconscious exchange of bodily fluids as saliva, and infections.

Oro-genital contact is considered a *Saviolum* kiss. While this commonly occurs in heterosexuals, it’s also frequently practiced between LGBTQ2 (homosexual) gay couples. Discussions on these oro-genital activities may be found in appropriate texts on sexual behavior. Genital lubricating fluids, sperm, microbes and viruses all may be introduced into the mouth with this practice. (2) (3) These major types of kisses have been implicated in transmitting disease.

Aim: This appraisal assesses [I] socially sanctioned kissing habits, [II] examines the presence of Human Papilloma Virus [HPV] in saliva and salivary tests for HPV, [III] reviews protection from HPV vaccines, and critiques the oncogenic potential of HPV

Supplementary information The online version of this article (<https://doi.org/10.15520/jmrhs.v3i9.245>) contains supplementary material, which is available to authorized users.

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from peri-osculation practices, [IV] deconstructs behavior modification and changes in attitudes, and discusses implications of HPV in saliva as an indication of infection and potential for carcinogenesis from kissing..

1. **Kissing:** Kissing releases a wide range of reactions, from evoking positive pleasurable psychological, emotional, physical and/or physiological responses, to neural and cardiovascular reflexes. In healthy people one or more of these may be experienced, during or after a kiss. (3) Physiological, physical and emotional reflexes from kissing promotes glandular fluid flow into the mouth and genitalia. (3) (4) In these bodily fluids resides human cells which may include acquired viral DNA. (4) (5) (6) (7) . Human papilloma viruses, (HPV's) are also transmitted between individuals through saliva (8) (9) and HPV's not only affects women but also Men. (10)
2. **HPV in Saliva and tests using Saliva:** In the general population oral HPV infection has a prevalence of 7 percent with a bimodal distribution. Oral HPV infection is more prevalent in men compared with women, with a frequency prevalence ratio of 2.3, and a peak incidence nearly 10% in males between ages 55 to 64 years. Within the general population, about 1% are infected with subtype HPV-16. (11) HPV's are independent risk factors for oro-pharyngeal cancers. HPV modulates oncogenesis in tobacco- and alcohol-induced oro-pharynx tumors, but are also primary oncogenic factors inducing carcinogenesis among non-smokers. (12) Specific HPV subtypes are causally associated with Head and Neck Cancers (HNCs). For example HPV 16 is likely to be the etiologic factor in a subset of head and neck squamous cell carcinomas (HNSC). Using PCR methodology, quantitative analysis of HPV 16 DNA in salivary rinses allows for detection of HPV-related HNSC (13) Amongst the most common cancers worldwide with increasing prevalence, are head and neck squamous cell carcinomas. These neoplasias are extremely challenging to treat because detection occurs late in the development

of the cancers. Yet cancers induced by HPV can be detected by salivary as well as blood tests. HPV tumor DNA cancers of the oral cavity can be detected early as well as most be most head and neck cancers. Tumor DNA may be demonstrated in saliva prior to clinical manifestation of tumor recurrence. (13) (14) While the overall incidence of non-HPV head and neck cancer is decreasing in the United States, cases of diagnosed HPV+ve oro-pharyngeal squamous cell carcinoma (OPSCC) are on the rise. This is ascribed to changing sexual practices, oro-genital sex contact, and a marked increase of oro-pharyngeal cancer from high-risk HPV's. Global kissing habits do not change and are responsible for transmission of HPV and other viruses within communities. These viruses infect both sexes and all ages. (21-25) Combining measures from pretreatment saliva and plasma, the sensitivity of pretreatment HPV-16 status is increased and can be used for screening for HPV-16-positive OPSCC. HPV-16 DNA analysis in saliva and plasma post primary treatment allows for earlier detection of recurrence of HPV-16-positive OPSCC. (15)

3. **Prophylaxis against HPV. The Human Papilloma Viruses (HPV)** were as regarded as benign with few variants. (16) (17) (18) (19) Over 150 varieties of HPV have been identified serologically, some of which are benign, but many of which are oncogenic by modifying mutant genes. (20) Gardasil® and Cervarix® are vaccines against these genes, and were initially introduced and recommended for young girls before their sexual debut. (21) A new broader antigen based HPV vaccine now exists for clinical use (2019); it is called the V503 by Merck. [Merck (MRK), known as MSD outside the United States and Canada.] (22) . Salivary transmission through close social contact [which includes frequent hugging, embracing , non-sexual] and sexual activity all facilitate transmission and spread of HPV. Some religious authorities of organized religion object to embracing HPV vaccines, claiming it's use will lead to promiscuity. (23) **HPV spread is**

transmitted by close social proximity without any genital contact, but through ubiquitous kisses between people of all ages. Commonly, kissing is part of these behaviors and unwittingly people transmit HPVs. (24) (25)]. The use of vaccines for pan-public protection should target both boys and girls to maximize its benefit, as well as those adults who expect to have more than one sexual partner. (22) (23) (24) (25)

4. Behavior Modification and Changes in Attitudes. Kissing is globally practiced in the various forms indicated. Kissing is often used as an expression of affection not only between adults of opposite sexes, but also world-wide in most LGBTQ2 communities, and also within families, between parents and children, and among siblings. (2) (3). The minor pleasures derived from kissing are repeated and asking people to give up this practice is well nigh impossible. The emotional, physiological and psychological responses are well known (3), (53) and while social kissing is ubiquitous, kissing is consistently regarded by most as an essential part of foreplay for coitus. Yet kissing easily transmits infected HPV material from one person to another. Many people refuse to indulge in wet kisses except after marriage. Intimate kissing as saviolum, fellatio or oral cunnilingus, and/or oro-genital contact should be reserved for life-long partners. Prophylaxis through vaccination against HPV infection and its' sequaelae is strongly recommended.

2 | DISCUSSION:

Kissing and saliva play an important and significant role in the realization of oral and head and neck cancers. HPV also plays a role in uro-genital and gastro-intestinal cancers; these are not discussed here. Head and Neck Squamous Cell Carcinoma (HNSCC) has an annual incidence of 633 000 which globally makes it the sixth most common cancer resulting in a global mortality of 355000. Mouth squamous cell carcinoma (OSCC) and oro-pharyngeal squamous cell carcinoma (OPSCC) together are the

most prevalent types of HNSCC, with a global incidence of 263,900 new cases and 128,000 deaths in 2008. (26) The main anatomical locations of occurrence for HNSCC are the oral cavity, oropharynx, nasopharynx, hypopharynx, and larynx. (27) As with many neoplasias, early diagnosis of HNSCC leads to successful treatments with treatments including chemotherapy, radiation therapy, surgical excision or various sequences of these therapeutic modalities. Because early detection often escapes clinical and subjective notice, many patients present with late stage disease with metastatic nodal lymphadenopathy (regional 43%, and distant 10%), with consequential 5-year survival of less than 60%. (28) Drinking alcohol, and tobacco smoking act synergistically and are strongly implicated in aggravating the prevalence of oncogenesis in the aforementioned sites. (29) (30) (31) Genital warts are caused by HPV 6 and HPV 11, and for decades these were regarded as benign infections. Even though the incidence of HNSCC is in decline in the developed world because of reduced tobacco use, there is a rampant increase in new cases of OPSCC from HPV infection. HNSCC patients with HPV-associated OPSCC in general do not have a history of tobacco or alcohol use, but some 60% of OPSCC patients diagnosed in the western world are positive for at least one or more oncogenic forms of HPV types 6, 11, 16, 18, 31, 33, 45, 52, and 58. (32) HPV-positive HNSCCs undergo genetic modification from HPV oncoproteins, E6 and E7, that neutralize tumor suppressor proteins p53 and Rb, respectively. HPV-positive HNSCCs alter their allelic and chromosomal stability and other cellular gene expression products including altering DNA methylation profiles. (33)

3 | HPV IN SALIVA AND COF:

Kissing allows for transmission of bodily fluids, particularly saliva. Saliva derives from the major salivary glands (parotid, submandibular, sublingual) and minor salivary glands in the oral mucosae. Whole saliva reflects the presence of HPV. Although most definitive histological and histochemical diagnostic assays are done with excised tumor tissues during surgery as incision biopsy or total resection, cur-

rently (2020) mixed saliva is used frequently for HPV detection from HNSCC's. Because it is easily accessible, noninvasive, cost-effective nature, and often in close proximity to oral tumors, saliva provides data for early detection of HPV, neoplastic change, and monitoring of disease progression. (34)

. **Collected oral fluid (COF)** containing whole saliva and all other oral glandular secretions, also contains nearly all the biochemical molecules [Though in lower titers] found in whole blood or serum. COF has a wide variety of biochemical metabolites and a host of microbiota. These include viruses, bacteria, and fungi, but also antibodies, hormones, steroids, growth factors, cytokines and chemokines, which derive from local and systemic diseases. (35) (36) (37) . Administered drugs are found within COF twenty minutes after administration. COF also contains whole cells, genetic materials, as well as proteins that may allow for the detection of HPV and cellular alterations in infected cells, which may aid in early detection and HPV-typing of HNSCC tumors. (38) (39)

Oncogenic associated HPV's are found in oral exfoliated cells in collected oral fluids [COF] from patients with head and neck cancers [HNC]. (39) Although early HR-HPV DNA testing in COF with quantitative analysis allowed for detection of HPV-associated HNSCC, these tests were not reliably predictive of HNSCC in general. (40) (41) (42) Subsequently patients with HR-HPV DNA [RT-qPCR of HPV16 E6 and E7] in COF rinses after treatment for HNC show a significant risk for tumor recurrence. (41) (42) Patients with HR-HPV DNA in oral rinse post-treatment are at significant risk for tumor recurrence, as HR-HPV DNA were more likely to be present in oral rinse of HPV+ than HPV- HNSCC patients before and after therapy. (43) The presence of HPV DNA in oral rinse is significantly correlated with the presence of HPV DNA in tumor and HPV-specific antibodies in sera. (44) The combination of HPV16 and abnormal cytology are detected in oral samples (tonsillar brush and oral rinse) of patients with precursor lesions, but not HIV+ individuals, and was associated with OSCCs (45) That immune status affects colonization of HPV is indicated by the fact that, although men have a higher prevalence of HPV infection, women who are deficient in total IgA salivary secretion are more prone to

having their oral mucosa and saliva colonized by HPV. (45) (46) The presence of HPV DNA in oral COF samples is significantly correlated with HPV-positive tumors in the tonsillar and base of tongue region. (47) (48) (49) (50) . Oral cancers from the tongue will exfoliate cells into COF and HPV's are detected in these lingual cancer cells. (50) Although there are more than 150 serotypes of HPV, at least 9 [HPV types 6, 11, 16, 18, 31, 33, 45, 52, and 58] have been implicated in oncogenesis. There is antigenic cross-reactivity among these cited HPV's, by inducing targeted powerful active antibodies against forming cancer, and Gradasil9, a HPV 0-valent recombinant vaccine, has proven to be over 90% successful, provided vaccination inoculation guidelines are followed. (51) .

Concluding remarks: HPV is recognized as an independent risk factor for a subset of HNSCC and HPV positivity in saliva [COF] indicates the predisposition, existence or recurrence of HNC. (52) All HPV's are not the same, and while some may be benign, many carry DNA sequences that induce oncogenesis. Most HPV infections will not progress to cancer, but, delayed elimination of HPV infection may hold the risk factors for development of organ cancers. HPV should not be regarded as a strictly genital infection, but a viral infection that affects the mouth and oropharynx, as well as the gastro intestinal and respiratory tracts, as well as the genitourinary system. (53) Prophylaxis against HPV carcinogenesis is available, and vaccination is advised for all young adults before their sexual debut, and for those who are likely to have more than one sexual partner. Kissing is practiced globally and frequently and is the widest and most common form of transmitting HPV viruses.(16-25) HPV positivity in OPSCC is associated with a reduction in the risk of death compared to patients with HPV-negative tumors. (53) Oral exfoliated cells and tumor tissues in COF from HNSCC patients reflects a highly significant correlation between HR-HPV detected in COF and the HR-HPV types present in tumor tissues. (53) (54) . This is a fundamental factor in grasping the most important aspect of kissing; open mouth kissing and oro-genital kissing transmits infected HPV material to vulnerable partners. (54)

4 | CONCLUSION:

Kissing is no stranger to danger. (55) Intimate kissing and oro-genital contact should be reserved for life-long partners. Prophylaxis against HPV infection and its' sequaelae is strongly recommended.

Authors statement: The authors have no conflicts of interest to declare.

Ethics: No IRB certificate was required for this review.

REFERENCES

1. Kirshenbaum S. Quoted as Stories of the Heart. A Brief History of Kissing. National Post. New York, NY: Grand Central Publishing; 2011.
2. Touyz LZG. Kissing: sublime or profane, sublime or insane. *Probe and Mirror*. 2011;39:3–4.
3. Touyz LZG, Lips. Kissing and Oral Implications. *Jnl Aesthetic Dent UK* Sept. 2009;(3):29–34.
4. Masters WH, Ve J. *Human Sexual Response* First Edition 1966 Ch;3:171–176.
5. Baron S, Poast J, Richardson CJ, Nguyen D, Cloyd M. Oral Transmission of Human Immunodeficiency Virus by Infected Seminal Fluid and Milk: A Novel Mechanism. *The Journal of Infectious Diseases*. 2000;181(2):498–504. Available from: <https://dx.doi.org/10.1086/315251>. doi:10.1086/315251.
6. Schattenfroh S. HIV–transmission by kissing. *Dtsch Med Wochenschr*. 1997;122(39).
7. Kissing reported as possible cause of HIV transmission. *Journal Canadian dental Association*. 1997;63(8).
8. Nair S, Pillay MR. Human Papilloma Virus & disease Mechanisms: relevance to oral and cervical cancers. *Oral Dis*. 2005;11(6):350–359.
9. Donovan B; 2004.
10. Partridge JM, Koutsky LA. Genital human papillomavirus infection in men. *The Lancet Infectious Diseases*. 2006;6(1):21–31. Available from: [https://dx.doi.org/10.1016/s1473-3099\(05\)70323-6](https://dx.doi.org/10.1016/s1473-3099(05)70323-6). doi:10.1016/s1473-3099(05)70323-6.
11. Gillison ML, Broutian T, Pickard RK. Prevalence of oral HPV infection in the United States. *JAMA*. 2009;307(7):693–703.
12. Zhao M, Rosenbaum E, Cavalho AL, Koch W; 2005.
13. Wang Y, Springer S, Mulvey XL, Silliman N. Detection of somatic mutations and HPV in the saliva and plasma of patients with head and neck squamous cell carcinomas. *Science Translational Medicine*. 2015;.
14. Ahn SA, Chan JYK, Zhang Z, Wang H. Saliva and Plasma Quantitative Polymerase Chain Reaction-Based Detection and Surveillance of Human Papillomavirus-Related Head and Neck Cancer. *JAMA Otolaryngol Head Neck Surg*. 2014;140(9):846–854.
15. Turner DO, Williams-Cocks SJ, Bullen R, Catmull J; 2011.
16. Jensen AB, Link CC, Lancaster WD. Elsevier; 1982.
17. Norkin LC. *Virology: Molecular biology and pathogenesis*. Ch 16. Papillomaviruses. 2010. American Society for Microbiology Press; 2010. p. 419–443.
18. LAJER CB, BUCHWALD CV. The role of human papillomavirus in head and neck cancer. *APMIS*. 2010;118(6-7):510–519. Available from: <https://dx.doi.org/10.1111/j.1600-0463.2010.02624.x>. doi:10.1111/j.1600-0463.2010.02624.x.
19. Touyz L. *Human Papilloma Virus (HPV)-A Biological and Clinical Appraisal*: 2013. Science Postprint. 2013;1(1):1–1. Available from: <https://dx.doi.org/10.14340/spp.2013.10r0002>. doi:10.14340/spp.2013.10r0002.

20. Forman D, de Martel C, Lacey CJ, Soerjomataram I, Lortet-Tieulent J, Bruni L, et al. Global Burden of Human Papillomavirus and Related Diseases. vol. 30. Lyon, France: Elsevier BV; 2012. Available from: <https://dx.doi.org/10.1016/j.vaccine.2012.07.055>. doi:10.1016/j.vaccine.2012.07.055.
21. Touyz LZG. HPV vaccines? Still needed. *Current Oncology*. 2016;23(4):330–330. Available from: <https://dx.doi.org/10.3747/co.23.3034>. doi:10.3747/co.23.3034.
22. SYRJÄNEN S. Current concepts on human papillomavirus infections in children. *APMIS*. 2010;118(6-7):494–509. Available from: <https://dx.doi.org/10.1111/j.1600-0463.2010.02620.x>. doi:10.1111/j.1600-0463.2010.02620.x.
23. Touyz SJJ, Touyz LZG. The Kiss of death: HPV rejected by religion. *Current Oncology*. 1920;1:52–53.
24. Liu XY, Feng AH, Cui YM, Tobe RG; 2013.
25. Touyz LZG, Touyz S, Nassani J, M L. Kissing No stranger to Danger. *Intl Jnl Current Research*. 2012;10:5–5.
26. Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D. Global cancer statistics. *CA: A Cancer Journal for Clinicians*. 2011;61(2):69–90. Available from: <https://dx.doi.org/10.3322/caac.20107>. doi:10.3322/caac.20107.
27. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *International Journal of Cancer*. 2010;127(12):2893–2917. Available from: <https://dx.doi.org/10.1002/ijc.25516>. doi:10.1002/ijc.25516.
28. Leemans CR, Braakhuis BJM, Brakenhoff RH. The molecular biology of head and neck cancer. *Nature Reviews Cancer*. 2011;11(1):9–22. Available from: <https://dx.doi.org/10.1038/nrc2982>. doi:10.1038/nrc2982.
29. Sturgis EM, Cinciripini PM. Trends in head and neck cancer incidence in relation to smoking prevalence. *Cancer*. 2007;110(7):1429–1435. Available from: <https://dx.doi.org/10.1002/cncr.22963>. doi:10.1002/cncr.22963.
30. Hashibe M, Brennan P, Benhamou S, Castellague X. Alcohol drinking in never users of tobacco, cigarette smoking in never drinkers, and the risk of head and neck cancer: pooled analysis in the International Head and Neck Cancer Epidemiology Consortium. *J Natl Cancer Inst*. 2007;99:777–789.
31. Pelucchi C, Gallus S, Garavello W, Bosetti C, Vecchiac L. Cancer risk associated with alcohol and tobacco use: focus on upper aerodigestive tract and liver. *Alcohol Res Health*. 2006;29:193–198.
32. Marur S, D’Souza G, Westra WH, Forastiere AA. HPV-associated head and neck cancer: a virus-related cancer epidemic. *The Lancet Oncology*. 2010;11(8):781–789. Available from: [https://dx.doi.org/10.1016/s1470-2045\(10\)70017-6](https://dx.doi.org/10.1016/s1470-2045(10)70017-6). doi:10.1016/s1470-2045(10)70017-6.
33. Dahlgren L, Mellin H, Wangsa D, Heselmeyer-Haddad K, Björnestål L, Lindholm J, et al. Comparative genomic hybridization analysis of tonsillar cancer reveals a different pattern of genomic imbalances in human papillomavirus-positive and -negative tumors. *International Journal of Cancer*. 2003;107(2):244–249. Available from: <https://dx.doi.org/10.1002/ijc.11371>. doi:10.1002/ijc.11371.
34. Punyadeera C, Slowey P, D. Saliva as an emerging biofluid for clinical diagnosis and applications of MEMS/NEMS in salivary diagnostics in. In: Subramani K, Ahmed W, Jr JKH, editors. *Nanobiomaterials in clinical dentistry*. Elsevier; 2013. .
35. Pfaffe T, Cooper-White J, Beyerlein P, Kostner K, Punyadeera C. Diagnostic Potential of Saliva: Current State and Future Applications. *Clinical Chemistry*. 2011;57(5):675–687. Available from: <https://dx.doi.org/10.1373/clinchem.2010.153767>. doi:10.1373/clinchem.2010.153767.

36. Lima DP, Diniz DG, Moimaz SAS, Sumida DH, Okamoto AC. Saliva: reflection of the body. *International Journal of Infectious Diseases*. 2010;14(3):e184–e188. Available from: <https://dx.doi.org/10.1016/j.ijid.2009.04.022>. doi:10.1016/j.ijid.2009.04.022.
37. Anderson KS, Wong J, D'Souza G, Riemer AB, Lorch J, Haddad R, et al. Serum antibodies to the HPV16 proteome as biomarkers for head and neck cancer. *British Journal of Cancer*. 2011;104(12):1896–1905. Available from: <https://dx.doi.org/10.1038/bjc.2011.171>. doi:10.1038/bjc.2011.171.
38. Zhang X, Wan Y, Cooper-White J, Dimeski G, Atherton J, Punyadeera C. Quantification of D-dimer levels in human saliva. *Bioanalysis*. 2013;5(18):2249–2256. Available from: <https://dx.doi.org/10.4155/bio.13.190>. doi:10.4155/bio.13.190.
39. Smith EM, Ritchie JM, Summersgill KF, Hoffman HT, Wang DH, Haugen TH, et al. Human Papillomavirus in Oral Exfoliated Cells and Risk of Head and Neck Cancer. *JNCI Journal of the National Cancer Institute*. 2004;96(6):449–455. Available from: <https://dx.doi.org/10.1093/jnci/djh074>. doi:10.1093/jnci/djh074.
40. Zhao M, Rosenbaum E, Carvalho AL, Koch W, Jiang W, Sidransky D, et al. Feasibility of quantitative PCR-based saliva rinse screening of HPV for head and neck cancer. *International Journal of Cancer*. 2005;117(4):605–610. Available from: <https://dx.doi.org/10.1002/ijc.21216>. doi:10.1002/ijc.21216.
41. Chuang AY, Chuang TC, Chang S, Zhou S. Presence of HPV DNA in convalescent salivary rinses is an adverse prognostic marker in head and neck squamous cell carcinoma. *Oral Oncol*. 2008;44:915–919.
42. Agrawal Y, Koch WM, Xiao W, Westra WH, Trivett AL, Symer DE, et al. Oral Human Papillomavirus Infection Before and After Treatment for Human Papillomavirus 16-Positive and Human Papillomavirus 16-Negative Head and Neck Squamous Cell Carcinoma. *Clinical Cancer Research*. 2008;14(21):7143–7150. Available from: <https://dx.doi.org/10.1158/1078-0432.ccr-08-0498>. doi:10.1158/1078-0432.ccr-08-0498.
43. Koslabova E, Hamsikova E, Salakova M, Klozar J, Foltynova E, Salkova E, et al. Markers of HPV infection and survival in patients with head and neck tumors. *International Journal of Cancer*. 2013;133(8):1832–1839. Available from: <https://dx.doi.org/10.1002/ijc.28194>. doi:10.1002/ijc.28194.
44. Tachezy R, Klozar J, Rubenstein L, Smith E, Saláková M, Šmahelová J, et al. Demographic and risk factors in patients with head and neck tumors. *Journal of Medical Virology*. 2009;81(5):878–887. Available from: <https://dx.doi.org/10.1002/jmv.21470>. doi:10.1002/jmv.21470.
45. Gonçalves AKS, Giraldo P, Barros-Mazon S, Gondo ML, Amaral RL, Jacyntho C. Secretory immunoglobulin A in saliva of women with oral and genital HPV infection. *Elsevier BV*; 2006. Available from: <https://dx.doi.org/10.1016/j.ejogrb.2005.06.028>. doi:10.1016/j.ejogrb.2005.06.028.
46. Adamopoulou M, Vairaktaris E, Panis V, Nkenke. HPV detection rate in saliva may depend on the immune system efficiency. *In Vivo*. 2008;22:599–602.
47. Nordfors C, Vlastos A, Du J, Ährlund-Richter A, Tertipis N, Grün N, et al. Human papillomavirus prevalence is high in oral samples of patients with tonsillar and base of tongue cancer. *Oral Oncology*. 2014;50(5):491–497. Available from: <https://dx.doi.org/10.1016/j.oraloncology.2014.02.012>. doi:10.1016/j.oraloncology.2014.02.012.
48. Hammarstedt L, Lindquist D, Dahlstrand H, Romanitan M, (Dahlgren) LO, Joneberg J, et al. Human papillomavirus as a risk factor for the increase in incidence of tonsillar cancer. *International Journal of Cancer*. 2006;119(11):2620–2623. Available from: <https://dx.doi.org/10.1002/ijc.22177>. doi:10.1002/ijc.22177.

49. Chai RC, Lambie D, Verma M, Punyadeera C. Current trends in the etiology and diagnosis of HPV-related head and neck cancers. Wiley; 2015. Available from: <https://dx.doi.org/10.1002/cam4.424>. doi:10.1002/cam4.424.
50. Dahlgren L, Dahlstrand HM, Lindquist D, Högmo A, Björnestål L, Lindholm J, et al. Human papillomavirus is more common in base of tongue than in mobile tongue cancer and is a favorable prognostic factor in base of tongue cancer patients. *International Journal of Cancer*. 2004;112(6):1015–1019. Available from: <https://dx.doi.org/10.1002/ijc.20490>. doi:10.1002/ijc.20490.
51. Masterson L, Moualed D, Liu ZW, Howard JEF, Dwivedi RC, Tysome JR, et al. De-escalation treatment protocols for human papillomavirus-associated oropharyngeal squamous cell carcinoma: A systematic review and meta-analysis of current clinical trials. *European Journal of Cancer*. 2014;50(15):2636–2648. Available from: <https://dx.doi.org/10.1016/j.ejca.2014.07.001>. doi:10.1016/j.ejca.2014.07.001.
52. Fakhry C, Rosenthal BT, Clark DP, Gillison ML. Associations between Oral HPV16 Infection and Cytopathology: Evaluation of an Oropharyngeal "Pap-Test Equivalent" in High-Risk Populations. *Cancer Prevention Research*. 2011;4(9):1378–1384. Available from: <https://dx.doi.org/10.1158/1940-6207.capr-11-0284>. doi:10.1158/1940-6207.capr-11-0284.
53. Chai RC, Lambie D, Verma M, Punyadeera C. Current trends in the etiology and diagnosis of HPV-related head and neck cancers. Wiley; 2015. Available from: <https://dx.doi.org/10.1002/cam4.424>. doi:10.1002/cam4.424.
54. Kissing reported as possible cause of HIV transmission. *Journal Canadian dental Association*. 1997;63(8).
55. Touyz L, Touyz S, Nassani LM. Kissing; No stranger to danger. *International Journal of Medical Science and Health Research International Journal of Current Research*. 2018;10:70095–70098.

How to cite this article: Touyz L.Z.G., Touyz S.J.J. Kissing, Saliva and Human Papilloma Virus: Principles, Practices, and Prophylaxis. *Journal of Medical Research and Health Sciences*. 2020;1078–1085. <https://doi.org/10.15520/jm-rhs.v3i9.245>