Oral sex and the transmission of viral STIs

Review

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Objective: To review the literature on the role of oral sex in the transmission of viral sexually transmitted infections (STIs).

Method: A Medline search was performed using the keywords oro-genital sex, and those specific to each infection. Further references from each article identified by Medline were also included, as were relevant references from "Current contents".

Conclusions: Oral sex is a common sexual practice among both heterosexual and homosexual couples. The evidence suggests that HIV transmission can take place through oro-genital sex from penis to mouth and vagina to mouth. Case reports describe apparent transmission from mouth to penis although this appears less likely. The risk of oro-genital transmission of HIV is substantially less than from vaginal and anal intercourse. Receptive oro-genital sex carries a small risk of human papillomavirus infection and possibly hepatitis C, while insertive oro-genital contact is an important risk factor for acquisition of HSV 1. Oro-anal transmission can occur with hepatitis A and B. The transmission of other viruses may occur but is unproved. The relative importance of oral sex as a route for the transmission of viruses is likely to increase as other, higher risk sexual practices are avoided for fear of acquiring HIV infection.

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For the purposes of this review the term oral sex is taken to include oro-genital and oro-anal sex but to exclude kissing. Oral sex is a common practice in both heterosexual and homosexual relationships.[1] Vaginal intercourse remains the most commonly reported activity between heterosexual couples, although 72.9% of men and 66.2% of women had experienced cunnilingus, while 69.4% of men and 64% of women had experienced fellatio.[1] This compares with much lower rates found by Kinsey in the 1940s and 1950s.[2 3] Contemporary culture is approving of oro-genital sex, and during the 1970s and 1980s premarital oral sex has increased dramatically[4] and in one study more adolescent girls had received oral-genital stimulation than had vaginal intercourse.[5] Among homosexual men there is evidence of declining rates of anal intercourse as a response to the HIV epidemic,[6] and recent homosexual contact is more likely to be oro-genital or non ano-penetrative.[1] Oral sex has therefore become a relatively more important route for the transmission of sexually transmitted infections (STIs). This and a subsequent article aim to review the literature on oral transmission of viral and non-viral STIs.

Human immunodeficiency virus (HIV)

HIV is found in semen,[7] vaginal secretion,[8] and, at much lower levels, in saliva.[9] Apart from the level of HIV in saliva, other factors which may influence rates of transmission of HIV by oral sex are, firstly, the finding that other components of saliva inactivate the virus[10] and, secondly, a lack of expression of potential receptors for HIV in oral mucosa.[11] Thirdly, the presence of other pharyngeal infections may act as a cofactor in transmission.[12] Although no clear evidence exists, it seems likely that inflammation of the mucosa and blood staining of saliva (which are particularly common with some oral manifestations of HIV) will influence the risk of transmission. Finally, microscopic physical trauma during oro-genital contact may also be important.

HOMOSEXUAL TRANSMISSION
Male to male
The original reports on the sexual transmission of HIV came from the early years of the American epidemic among homosexual men, when unprotected anal sex was common, and HIV infection was a virtual certainty if there was unprotected receptive anal intercourse with six or more different partners.[13–15] These studies concluded that there was negligible risk of HIV acquisition from oro-genital sex, however it may be that the risk was obscured by the frequent practice of higher risk activities. Behaviour has changed since that time,[6] and there is an increasing number of case reports of transmission following oro-genital sex between men. Seroconversion has occurred during receptive oro-genital sex both with[16 17] and without[18 19] ejaculation. Receptive oro-genital sex was a risk factor in three out of the five cases reported by Rozenbaum *et al*.[20] However the other two patients denied any contact other than insertive fellatio and "deep kissing". Two further cases of HIV infection following insertive oro-genital sex have been reported; in one of these cases phylogenetic analysis supports the epidemiological data.[21] In a study of primary HIV infection Schacker *et al* found that four of the 46 patients enrolled in the study reported having only unprotected oro-genital contact, including a documented case of infection after performing fellatio.[22] If true, it seems that blood stained saliva must

Table 1 *Evidence for the transmission of viral STIs by oral sex*

Infection	Nature of risk	Evidence	References
HIV	Fellatio:	Case reports:	
	oral partner	with ejaculation	16, 17, 20
		without ejaculation	18, 19, 22, 31
	penile partner	Case reports	20, 21, 33, 34
	Cunnilingus	Case report (between lesbian women, NB possible under-reporting of bisexual behaviour)	27
	oro-genital/oro-anal contact	Cohort studies	23, 25*, 26
	(general)	Higher reporting of oral contact between infected partners	29
HSV	to genital partner	Rising cases due to HSV 1 (esp women)	38, 39, 40, 41, 42, 48
		Case report after receptive fellatio	46
		Documented orogenital contact in HSV 1 cases	47, 48
HPV	to oral partner	Case reports of oral warts	62, 63, 68
		Genital HPV types in oral mucosa	64, 65, 66, 67, 74, 75
		Studies suggestive of risk	50, 62, 67, 61
		Case report of oral bowenoid papulosis	77
	to genital partner	Inc risk of cervical cancer with cunnilingus/fellatio	69
Hepatitis B	Risk to oral partner in oro-anal sex	Cohort study of prevalence and factors associated with transmission	82
		Rectal lesions and HBsAg	85
		Cohort study	81
Hepatitis A	Risk to oral partner in oro-anal sex	Higher rates of seropositivity in homosexual men	90
		Epidemics among homosexual men	91, 92
Hepatitis C	Risk with oro-genital contact	Cohort study—marginal risk for oral sex with >25 partners	81
Molluscum contagiosum	To oral partner in oro-genital sex	Facial molluscum in AIDS patients	97
Kaposi's sarcoma (HHV8)	Oro-anal sex	Association found in one study	99

*Study shows borderline significance.

have been involved. In the Amsterdam cohort study of 102 homosexual men, 11 men only admitted to oro-genital contact before seroconversion, although two of these changed their history at interview.[23] The authors felt that the high proportion of men infected by this route was partly as a result of underreporting of higher risk activities in a group who were well informed about safer sex. This phenomenon has subsequently been found by others.[24] The largest study of oral sex as a potential HIV risk was of 741 homosexual men in the Netherlands, which suggested that oro-genital contact alone was a risk for HIV acquisition, although this result was not statistically significant.[25] However, Darrow *et al* were able to demonstrate that participants in a hepatitis B study had a higher risk of HIV infection from both oro-genital and oro-anal contact.[26]

Female to female
Perry *et al* have reported oro-genital transmission of HIV between women.[27] However, it may be that not all cases of apparent female to female oral transmission are genuine as there appears to be underreporting of bisexual activity.[28]

HETEROSEXUAL TRANSMISSION
Fischl *et al* evaluated heterosexual partners of adults with AIDS and found higher reporting of oral sex among infected partners, but did not differentiate between male:female and female:male exposure.[29]

Male to female
In heterosexual intercourse there is a differential in transmission between the sexes, with a higher risk of women acquiring the infection.[30] Two cases of HIV transmission by fellatio (without ejaculation) with a seropositive drug user have been reported in Italy,[31] while a larger study by Padian *et al* showed increased risk of transmission with increasing numbers of sexual contacts, irrespective of whether the contact was vaginal or oral.[32]

Female to male
Although there is known to be a lower overall risk of transmission from female to male,[30] there is little information on the relative risk of different sexual practices. Cases of infection following oral sex have been reported,[33 34] one of which involved an impotent diabetic man infected by fellatio from a prostitute.[33]

Herpes simplex virus
Historically, genital herpes was predominantly caused by herpes simplex virus type 2 (HSV 2),[35 36] but more recently there have been reports of both a rising incidence of new cases,[37 38] and a rise in the proportion due to HSV 1 in various centres in the United Kingdom.[38–40] This trend has also been reported in other countries with high or rising rates of genital herpes—for example, Japan,[41] and also in the United States—a study by Wald *et al* published in 1994[42] found 32% of primary herpes infections to be due to HSV 1 compared with the data from Corey *et al* in 1983 in which HSV 1 was isolated from only 10% of primary herpes.[43] The increase in isolation of HSV 1 has been predominantly in women, and accounted for up to 79% of female isolates and 39% of male cases in one series.[38] This would be compatible with the fact that both sexes report greater experience of cunnilingus than fellatio.[1] However, further data from Sheffield suggest that misdiagnosis of mild HSV 1 infection in men may partly explain this discrepancy.[44] Although some studies have reported that transmission of either viral type may be via oro-genital contact since concomitant pharyngitis may occur with primary genital infection,[45] none has specifically looked at the role of oral contact as the sole route of transmission. The development of an acute HSV 1 pharyngitis in a homosexual man

following insertive oral sex has recently been reported.[46] Reports of HSV 1 transmission suggest that oral sex is the predisposing factor, although information on the practice of oro-genital sex is often absent from the case notes.[47 48] The role of genito-genital spread of HSV 1 is probably less significant as genital HSV 1 infection recurs less often[45] and is associated with less subclinical shedding of virus.[49]

Human papillomavirus (HPV)

Genital warts form a large proportion of the workload for many genitourinary medicine clinics, and are generally thought to be sexually transmitted. The seroprevalence of HPV antibodies rises with increasing numbers of sexual partners,[50 51] and the incidence of HPV lesions on the cervix is also correlated with greater numbers of sexual partners and earlier age of coitarche.[52] However, studies of virgins have shown conflicting results, with no HPV detected either on analysis of tampons from virginal women[53] or in a longitudinal serological study.[54] HPV DNA was detected by Pao *et al* in premarital checks of virgins raising the possibility of transmission by mechanisms other than penetrative intercourse, although in this series no HPV DNA was detected in the husbands to be.[55] Transmission by fomites is plausible as HPV DNA has been isolated from equipment after examination of patients with genital warts,[56] but transmission via this route is not proved and is thought to be unlikely.[57] Hand-genital transmission is thought to occur[58] and oro-genital transmission is therefore plausible. Vertical transmission (and viral persistence) is known to occur[59] and is linked to juvenile respiratory papillomatosis.[60] In a study comparing juvenile respiratory papillomatosis with adult onset disease, affected adults reported a higher frequency of oral sex than controls.[61] The development of oropharyngeal warts is uncommon[62 63] but when present a large proportion are due to "genital" HPV types— that is, 6, 11, 16, 18.[64–67] One case report also temporally relates the development of an oral condyloma to cunnilingus with an infected partner.[68] Some studies suggest oro-genital transmission[50 62 67] while another study found a slight increase in the risk of cervical cancer with fellatio and cunnilingus, although this may be confounded by the increased number of partners in the group reporting oral contact.[69]

Asymptomatic HPV is well recognised in genital sites[50] and it is likely that asymptomatic infection in the mouth is commoner than manifest disease. Acetowhitening of the oral mucosa has been shown to be non-specific and should not be regarded as a diagnostic criterion for oral HPV infection,[70] but HPV DNA has been identified in the mouth.[71 72] HPV types 6 and 16 were identified in up to 24% of exfoliated oral mucosal cells in both normal children (suggesting persistence after perinatal infection) and in adults,[71] and HPV was found in five out of 12 biopsies of normal tissue in another series.[72] However, this was not confirmed in a further study in which 65 men and 111 women showed no evidence of oral HPV infection.[73]

HPV can also cause malignant change in the oral cavity and genital types (especially HPV 16) have been isolated from these lesions.[74 75] However, HPV is clearly not the sole risk factor for oral cancer. Indeed, one study found a lower incidence of oral sex in cancer sufferers than in controls.[76] Further evidence of oral pathology associated with HPV comes from the case report of a man being treated for Hodgkin's disease who had bowenoid papulosis on his penis and proved HPV associated severe epithelial dysplasia in his mouth, which the authors described as the first reported case of oral bowenoid papulosis.[77]

Hepatitis viruses

HEPATITIS B

Hepatitis B positivity has been known to be more frequent in STD clinic attenders, homosexual men, and prostitutes for many years,[78–80] and is commoner in patients with more sexual partners or a past history of STI in both homosexual[81–83] and heterosexual groups.[83] Antigen has been found in both semen and saliva,[84] and also in faeces,[85] although this has not been confirmed by all investigators.[86] Experimental transmission of hepatitis B has followed intradermal inoculation of saliva (in gibbons), but not after oral inoculation.[87] Although sexual transmission is felt to be an important route for the spread of infection in heterosexuals[88] the nature of the contact has not been addressed. More information is available on the relative risks of different sexual practices in homosexual men. The role of oro-anal contact is probably important as a risk for transmission from anus to mouth.[82 85] Transmission may be from faeces or from asymptomatic rectal bleeding which has been reported in homosexual men[85] and this would correlate with Kingsley and colleagues' finding of a higher risk from insertive than receptive anal intercourse.[89] Receptive oro-genital contact with more than 25 partners was associated with hepatitis B infection in another series[81] although the risk of transmission in this group may be confounded by the large number of partners. Kingsley *et al*[89] and Schreeder *et al*[82] failed to find an association between receptive oro-genital sex and HBV infection.

HEPATITIS A

As hepatitis A is an enteric pathogen and is excreted in the stools in high concentrations, it is not surprising that rates of infection are higher among homosexual men who report oro-anal contact. In Seattle the annual incidence was found to be 22% among seronegative individuals and there was a correlation between acquisition of hepatitis A and oro-anal contact, and also with increasing numbers of partners.[90] Epidemic outbreaks affecting homosexual men have occurred[91 92] and these also suggest that the oral role in oro-anal contact is the predominant risk, while oro-penile contact is unimportant.

HEPATITIS C

Sexual transmission in hepatitis C infection is uncommon.[93 94] Transmission is linked to the

presence of both hepatitis B and HIV which may act as cofactors, and a slightly higher prevalence of infection has been reported in homosexual men in one study.[95] Receptive orogenital contact with more than 25 partners was marginally associated with infection (OR 2.4), with a similar association with more than 50 partners per year (OR 2.1) and more than 25 anal receptive partners (OR 1.9).[81]

Miscellaneous

MOLLUSCUM CONTAGIOSUM
These are commonly found on the genitalia in adults,[96] and are frequently found on the face in homosexual men with AIDS.[97] This could represent spread from the skin around the genital area during oro-genital contact.

KAPOSI'S SARCOMA
A new herpes virus designated human herpes virus 8 (HHV8) has been isolated from patients with Kaposi's sarcoma.[98] One study has found oro-anal contact to be a risk factor for Kaposi's sarcoma in homosexual men.[99]

Conclusion
It is biologically plausible that transmission of HIV takes place through oro-genital sex from penis to mouth and vagina to mouth. This conclusion is supported by case reports. Further case reports suggesting transmission from mouth to penis are open to question on the basis that they are biologically less plausible unless blood stained saliva was involved. Epidemiological evidence indicates that oro-genital sex poses substantially less risk of HIV infection than vaginal and anal intercourse.

Receptive oro-genital sex is also a risk factor for acquisition of human papillomavirus and possibly hepatitis C. Insertive oro-genital sex is a risk factor for acquisition of HSV 1 on the genitalia. Oro-anal sex, with transmission to the mouth, occurs with hepatitis A and B. Transmission of other viruses by oral sex is plausible but unproved.

The use of condoms or dental dams should be discussed with patients to minimise their risk of acquiring infection.

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