Pediatric HIV Infection and Dental Caries in the Era of Antiretroviral Therapy in West Africa

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ABSTRACT

Background: The prevalence of dental caries is believed to be higher among HIV-infected (HIV+) children than in the general pediatric population. However, dental caries are not described as opportunistic infections and the association between dental caries and HIV infection is unclear in the literature. The objective of this study was to assess the association between the number of decayed, missing and filled permanent and temporary teeth surfaces (DMFdefS) and the HIV infection status among children in West Africa. **Methods:** A multi-center two-step cross-sectional survey was conducted within five clinical centers in Mali, Senegal and Côte d'Ivoire. A random sample of 5 to 15 years old HIV+ children in care and a sample of their non-infected siblings (HIV-) were recruited in 2011-2012. Seronegative status for HIV infection in this latter group was confirmed by ELISA tests conducted in the context of the national HIV program. Oral health data collection was conducted by five trained and calibrated dentists (Cohen's kappa coefficient 0.59 to 0.93). The association between the DMFdefS and the HIV infection status was analyzed using a zero-inflated negative binomial (ZINB) model. **Results:** 420 HIV+ children (84 or 20.2% with CD4 count<350 cells/mm³) and 418 HIV- siblings aged 4.4 to 15.7 years-old were enrolled. HIV+ children were more likely to attend school (93.0%) than their HIV- siblings (86.4%), had less frequently sweet drink intakes (71.7% vs. 80.6%) and were more likely to have ≥3 meals per day (68.8% vs. 79.4%). The median DMFdefS was 7 (interquartile range IQ: [2-15]) in HIV+ children and 2 (IQ: [0-7]) in HIV- siblings. The median defs and DMFS scores were respectively 5 and 2 in HIV+ children vs. 2 and 0 in HIV- children. The percentage of children affected with dental caries (%DMFdefS≥1) was significantly higher in HIV+ children (86.0%) than the non-infected ones (64.4%, p-value<0.001). The d- and D-components contributed to 94.8% of the DMFdefS in HIV+ children and to 96.6% in HIV- children. The multivariate analysis showed that HIV infection was significantly associated with a higher probability of presenting dental caries. In children at-risk for dental caries, HIV+ children had a mean DMFdefS significantly higher than HIV- children. **Conclusions:** Even if HIV+ children seemed to be less exposed to common risk factors for dental caries, they were more affected. Dental care and prevention for oral health are needed for HIV+ children and have to be included in pediatric multidisciplinary care teams in order to decrease comorbidities.

BACKGROUND

Background: The prevalence of dental caries is believed to be higher among HIV-infected (HIV+) children than in the general pediatric population. However, dental caries are not described as opportunistic infections and the association between dental caries and HIV infection is unclear in the literature (1-4).

OBJECTIVE

To assess the association between the number of decayed, missing and filled permanent and temporary teeth surfaces (DMFdefS) and the HIV infection status among children in West Africa.

METHODS

Study design: Multi-center cross-sectional survey within 5 pediatric HIV clinics participating in the IeDEA (International epidemiologic Databases to Evaluate AIDS) West Africa collaboration (5) in Abidjan, Bamako and Dakar (6)

Sample: A random sample of 5 to 15 years old HIV+ children on antiretroviral treatment (ART) and a sample of their non-infected siblings (HIV-) recruited in 2011 and 2012, respectively. HIV+ and HIV- children were matched on gender, age category (+/-12 years) and clinic.

Sample size: To distinguish a 10% difference of dental caries prevalence between HIV+ and HIV- children, with α=5% and power=95%, 420 children per group was needed.

Ethics An agreement was obtained from the local ethics committees and informed consent was collected from the caregivers.

Main outcome: Number of decayed, missing and filled permanent and temporary teeth surfaces (DMFdefS) (7)

Main exposure: HIV status measured by Elisa tests performed in the context of the National HIV Programs

Statistics : We used Fisher exact and Kruskall Wallis tests to compare characteristics between HIV+ and HIV- children and zero-inflated negative binomial (ZINB) model (8,9) to explore the association between DMFdefS and HIV infection status.

Data collection: It was performed through face-to-face interview and oral examination (performed by trained and calibrated dentists and medical record retrieval (performed by site pediatricians). The intra- and inter-examiner reliability was assessed for the experience of decay per tooth, with Cohen's Kappa values varying between 0.65 and 0.74, and between 0.58-0.81, respectively.

RESULTS

1. Participants

Table 1: Characteristics of the participants

	HIV- children (N=418) n (%)	HIV+ children (N=420) n (%)	p-value
Gender: male	221 (52.9)	223 (53.1)	0.95
Age ≥ 12 years	94 (22.5)	113 (26.9)	0.14
Caregiver: mother or father	281 (68.9)	266 (63.8)	0.12
History of night baby bottle intake	156 (40.6)	161 (40.9)	0.95
Food intakes> 3 per day	323 (79.4)	284 (68.8)	<0.01
Medicine syrup intake at study time	22 (5.4)	54 (13.2)	<0.01
Sweet drink intake	337 (80.6)	301 (71.7)	<0.01
Sugar food intake	382 (91.4)	367 (87.4)	0.06
Oral hygiene by the OHI-S Index			0.12
Good (OHI-S ≤ 1.2)	161 (38,5)	151 (36,0)	
Correct (1.2 < OHI-S ≤ 3.0)	236 (56,5)	232 (55,4)	
Poor (OHI-S > 3.0)	21 (5,0)	36 (8,6)	
Tooth brushing≥ 2 per day	117 (28.2)	143 (34.4)	0.06
Daily use of toothpaste	340 (82.3)	362 (87.9)	0.03

OHI-S: Oral Hygiene Index Simplified. HIV: Human Immunodeficiency Virus. VIH+: HIV-infected. VIH- : HIV non-infected

2. Characteristics of HIV+ children

- 99,3% HIV-1
- Median age of diagnostic : 4.3 years
- Median age of ART start : 5.3 years
- 20.2 % with CD4+ < 350 cells/mm³ (44.3 % at ART initiation)

3. Oral data

- 361 (86,0 %) VIH+ children had un DMFdefS>0 vs. 269 (64,4 %) children VIH- (p<0,001)
- Median DMFdefS has higher in children HIV+ (p<0,001) (Figure 1)

4. Adequation of the ZINB model

- The fit of the model was verified (Figure 2).

Figure 2: Distribution of the observed and predicted DMFdefS from 0 to 30 in the ZINB model

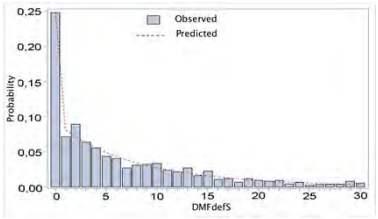
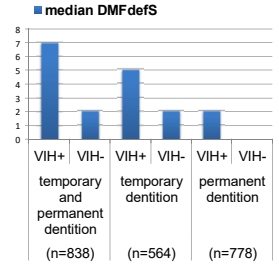


Figure 1: DMFdefS global and according to HIV status and dentition



5. Relationship between dental caries and HIV status (Table 2)

- The HIV+ children had significantly lower probability not to be at risk of having dental caries
- In children at risk of having dental caries, the HIV+ children had a mean DMFdefS significantly higher than non-infected children

Table 2 : Multivariate analysis of DMFdefS and HIV serologic status, ZINB model (N=819).

HIV status (VIH+/VIH-)	β	p
Logistic part	-1,507	<0,001
Counting part	0,654	<0,001

Adjusted by country, age, gender, sugar food intake and sweet drink intake outside the three mainly meals, medicine syrup intake and oral hygiene level

DISCUSSION

- In this study, even if HIV-infected children seemed to be less exposed to usual risk factors for dental caries, they were more affected than their non infected siblings.
- The main hypotheses to explain this observation from the literature were the immunodepressed status (10) and sugar medications intake (11). Castro *and al.* observed that caries prevalence in HIV-infected children increased with worsening clinical condition. However, the role of HIV infection on the oral mucosal immunity remains unclear. The association between dental caries and sugar contents in medications is well reported (12) but is not specific to HIV infection. The cariogenic potential of pediatric medications increases with the multiplicity of therapies and the treatment duration: the effect is cumulative by taking one or two antiretrovirals, antibacterials or further medications in case of co-infections.
- Our study has some limitations. First the information about dental caries, instructions on effective tooth brushing, and appropriate diet practices given to HIV+ children and their caregiver in 2011 may have been beneficial for HIV- siblings selected in 2012. This could have limited the increase of the DMFdefS in HIV- children, and overestimated the observed association. However, results showed that non-infected children were, at the study time, more exposed to feeding habits conducing to poor oral health. Second, children's HIV status was not blinded for the dentists which could have also led to overestimate the association.

CONCLUSIONS

Conclusions: Even if HIV+ children seemed to be less exposed to common risk factors for dental caries, they were more affected. Our findings highlight the need for effective oral care and prevention programs for HIV-infected children on ART in order to decrease comorbidities. Also, the physiopathological role of HIV infection on the development of dental caries should be clarified.

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