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Review Article

OraQuick® ADVANCE™ Rapid HIV-1/2 Antibody Test를 이용한 치과에서의 인간면역결핍바이러스 검사: 문헌고찰

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Abstract

HIV Screening Using the OraQuick® ADVANCE™ Rapid HIV-1/2 Antibody Test (OraQuick Test) in Dentistry: A Literature Review

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Purpose: The purpose of this study was to evaluate the use of OraQuick tests in previously reported articles.
Methods: The literature was searched using Pubmed Medline with keywords, such as "OraQuick" or "rapid HIV test". Articles that included the specificity and sensitivity of this device were reviewed.
Results: A total of 11 journal articles including 3 domestic articles were reviewed. The sensitivity of the OraQuick Test was reported to be 97.8 to 100% and its specificity was 98.8 to 100%.
Conclusion: The results indicated that the simple OraQuick assay has proven to be accurate and it can be used to detect patients with HIV and to prevent the spread of HIV on test screens.

Key words: Human immunodeficiency virus, Acquired immunodeficiency syndrome, Dental clinic

Introduction

According to data from the Korean Center for Disease Control and Prevention (KCDC), acquired immunodeficiency syndrome (AIDS) was first reported in Korea in 1985, and the incidence of the disease is increasing continuously (13.9% per year). By September 2009, 6,680 individuals infected with human immunodeficiency virus (HIV) had been diagnosed in Korea[1-3]. Such a rapid increase in the number of HIV cases is worrisome. Misunderstandings about AIDS and the risk of prejudice against HIV-infected people make AIDS difficult to detect; however, because of the public health aspects of this disease, early detection and treatments are very important[4,5].

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The current laboratory diagnostic methods for detecting HIV infection can be broadly divided into 2 types: serological methods and molecular biological methods[5]. Serological diagnostic methods include the enzyme-linked immunosorbant assay (ELISA), the HIV antigen test, and Western blot. Molecular biological methods include polymerase chain reaction (PCR), nucleic acid tests, and quantitative tests for HIV RNA. Additional diagnostic methods include HIV culture tests and product-enhanced reverse transcriptase assay (PERT)[6-8]. Enzyme immunoassays (EIA) may generate false positive or false negative results depending on the infective dose, the infection route, and the sensitivity of the test. To improve sensitivity and specificity of the test, better production methods of antigens were developed[7,8]. Nevertheless, the high false positive rates of EIA can cause confusion in medical teams and in patients[3,7,9]. So, the most widely used serological tests for confirmation of the HIV infection in the KCDC and Korean hospitals are Western blot methods due to its high specificities.

In the USA, the Center for Disease Control and Prevention (CDC) has attempted to prevent the spread of HIV infection, and the development of new diagnostic methods was one of the most important. Such diagnostic tools include the OraQuick® ADVANCE™ Rapid HIV-1/2 Antibody Test (OraQuick test, OraSure Technologies, Inc., Bethlehem, Pennsylvania, USA), the Reveal™ HIV-1 Antibody Test (MedMira Laboratories, Halifax, Nova Scotia), the Uni-gold Recombigen™ HIV Test (Trinity Biotech, Wicklow, Ireland), and the Multispot HIV-1/HIV-2 Rapid Test (BioRad Laboratories, Redmond, WA)[10].

Among these tests, the OraQuick test was approved by the American Food and Drug Administration (FDA) in 2004[11], and it tests for HIV-1 and HIV-2 using oral fluid, plasma and whole blood obtained from the finger tip or by venous tapping. This simple test is one of the immunochromatography (ICA), and can detect HIV-1 and HIV-2 within 20 minutes using blood from a finger prick. The sensitivity and specificity of this test had been proved to be very high comparable to the FDA-approved EIA. In 2000, OraQuick test was approved as a point-of-care test (POCT) to facilitate HIV diagnosis by trained personnel[12]. It was followed by OraQuick Advance Rapid HIV-1/2 Antibody Test, which could detect HIV-1/2 antibodies in oral fluid as well as in blood. The sensitivity and specificity of the OraQuick test for oral fluid samples was very high, and the FDA approved its use in 2004[13,14].

OraQuick Advance Rapid HIV-1/2 Antibody Test is composed of developer solution vial, specimen collection loop and test device with flap pad and result window. Test is performed following procedure; Oral fluid is collected by rubbing completely around the outer gums, both upper and lower using the flat pad and is not collected at the floor of the mouth, the inside of the cheek or the tongue. The flat pad of the device is inserted into the developer solution vial. Pink fluid is appeared and travel up the result window and test result is shown after 20 minutes. OraQuick Advance Rapid HIV-1/2 Antibody Test is pain-free testing without the need for blood or needles.

The one of the advantages of OraQuick test is its constant results regardless of the examiners because it is the Clinical Laboratory Improvement Amendment (CLIA)-waived product, and it needs minimal training for examiners[15,16].

The OraQuick test was approved by the Korean Food and Drug Administration (KFDA) in 2007. In 2008, the Ministry for Health, Welfare and Family Affairs designated the OraQuick test as a new medical technique. There are many studies on the medical usefulness of the OraQuick test in other countries[14,15,17-21]. However, in Korea, reports on the OraQuick are few in number; thus, a search of studies reported in Korea as well as in other countries was undertaken to review the usefulness of the OraQuick test for diagnosing HIV.

Materials and Methods

In May 2010, the literature was searched via Pubmed Medline using the keywords "OraQuick" or "rapid HIV test", and reports that surveyed specificity and sensitivity of these tests were selected and reviewed. And also 3 Korean literatures were found by searching.

1. Surveying contents

1) Literature pertaining to the sensitivity and specificity of the OraQuick test was examined along with studies of the test's recognition and consent rate.

2) Factors exerting the results of OraQuick test were examined.

Table 1. Summarized results of sensitivity and specificity of OraQuick test in literatures

Authors (year)	No.of subjects	Methods	Sensitivity	Specificity	Acceptance rate
Branson et al.[17]	1723 (USA)	Using blood samples and oral fluids (compare with other rapid diagnostic devices)	98.6% (blood) 98.6% (oral fluid)	99.9% (blood) 98.9% (oral fluid)	Not analysed
Reynolds et al.[19]	72 (HIV+) & 101 (HIV−)	Using oral fluids, compared to EIA and Western blot	100%	100%	Not analysed
O'Connell et al.[18]	101 (HIV+) & 100 (HIV−)	Using oral fluids	98%	100%	Not analysed
Delaney et al.[13]	12,337 (USA, multicenter)	Using blood samples & oral fluids	99.7% (blood) 99.1% (oral fluid)	99.9% (blood) 99.6% (oral fluid)	Not analysed
Wesolowski et al.[14]	135,724 (blood), 26,066 (oral fluids) (USA, multicenter)	Using blood samples & oral fluids	Not analysed	99.98% (blood) 99.89% (oral fluid)	Not analysed
Lee et al.[10]	57 (Korean)	Using oral fluids (53: HIV+, confirmed by Western blot; 4: HIV−)	98.1% (52/53)	100%	Not analysed
Holguín et al.[22]	139 (Spanish & south African)	Using oral fluids (previously diagnosed as HIV-positive)	97.8% (136/139)	-	Not analysed
Choi et al.[23]	124 (HIV+: 74, HIV−: 50, using CLIA analysis, Korean)	Using blood samples (re-test with OraQuick after frozen)	100%	98.8%	88.2% (30/34, only in serum HIV positive patients)
Pascoe et al.[24]	591 (Zimbabwe) HIV positive (415), HIV negative (176)	Using oral fluids	100%	100%	100% (591/591)
Piwowar-Manning et al.[25]	602 (Africans)	Using blood samples (compare to Abbott DETERMINE, Uni-Gold Recombigen)	99.3% (597/601)	99.3% (598/602)	Not analysed
Brown et al.[26]	1,560 (USA)	Using oral fluids (patients who visited ER), confirmed by Western blot in reactive cases)	Not calculated	100% (13/13)	49.3% (1,560/3,163)

Results

1. Sensitivity and specificity

The sensitivity and specificity of the OraQuick test was evaluated in several studies conducted in countries other than Korea. The sensitivity was reported to be 97.8 to 100%, and the specificity was reported to be 98.8 to 100%. In Korea, two studies were conducted, and comparable sensitivities and specificities were reported (Table 1). Nevertheless, in some studies, OraQuick tests using oral fluid were less specific than those using blood[13,14]. However, it is not known whether these results were statistically significant. Based on the results, the OraQuick test using oral fluid showed accuracy comparable to conventional western blot tests.

2. Acceptance of the OraQuick test by dentists and the general population

Park et al.[27] conducted a study of attitudes toward and knowledge about the OraQuick test among the general population and medical personnel in dental clinics. With regards to the test performed prior to open treatments in dentistry, both the general population and medical personnel had a high participation ratio (general population: 94%, medical personnel: 77%).

In addition, Freeman et al.[28] applied the OraQuick test to emergency room patients with a consent rate of 91% (94% in the 18 to 34 years group; 89% in the 35 to 54 years group, 87% in the 55 to 64 years group, and 85% in the adolescent group). In addition, in this study, the participants were classified according to risk levels and race. In the future, it was thought that studies according to individual's environments association with public health

are needed. In addition, Pascoe et al.[24] have reported that in cases using oral fluid, the consent rate was higher than in cases using blood. Similar results were reported in other studies[29].

3. False positive rate and the false negative rate

In tests using oral fluid, false positive results were reported in several studies[13,21,30-32]. Jafa et al.[30] reported the false positive rate of the OraQuick test of 4.1%, and when oral fluid sample use, the false positive rate of this test was strongly associated with older age (≥37 years old), Caucasian ethnicity, drug abuse, and homosexuality. In addition, in other studies, interpretation discrepancy among examiners about vague results, Epstein-Barr virus infection, Type A or Type B hepatitis virus infection, rheumatoid factor, multiparity, and pregnancy were speculated to be the causes[13,30,33]. In addition, it has been reported that false negative results may be obtained during seroconversion or early stage of HIV infection[13,20,34,35], patients being treated with antiviral agents[18], terminal stage of diseases[36], and due to examiner error[35,37].

Discussion

The OraQuick test, recently introduced to Korea, is a type of immunochromatography (ICA) test. Because its sensitivity and specificity are proven to be high, the OraQuick test has been used in some emergency departments to rapidly diagnose patients suspected of having HIV and for the control of infection during percutaneous accidents. It has been also used as a self-diagnosis test by individuals in high HIV-risk groups[13,14].

Blood-based EIA, which were widely used prior to the introduction of the OraQuick test, could be performed rapidly; however, results could not be obtained immediately. The problem with the EIA product currently used in Korea was its very low sensitivity[9]; this problem could be overcome by the introduction of the OraQuick test[38-41].

The OraQuick test mobilizes gp41 and gp36 peptides on nitrocellulose bands and can be performed with blood from finger sticks, venous blood, or the oral fluid obtained by swabbing the gingiva. The test result can be interpreted 20 to 40 minutes after immersing into tester developer solution vial, and results showing two red bands are positive.

In the USA, data from 368 institutions using the OraQuick test were collected. They revealed that the positive rate of OraQuick test was 0.8% (confidence level, 0.1～2.6%), specificity was 99.98% (99.7～100%), and the positive prediction rate was 99.2% (66.7～100%). The positive rate of 26,066 oral fluid specimens was 1.0% (0～4%), specificity was 99.89% (99.4～100%), and the positive prediction rate was 90.0% (50.0～100%)[14].

Brown et al.[26] performed the OraQuick test on 1,560 consenting patients who visited the emergency room. In that study, 13 HIV-positive patients were detected using the OraQuick test and then confirmed by western blot; thus, 100% specificity was shown. Nonetheless, because western blot was not performed on the remaining patients, sensitivity could not be calculated. In addition, the authors claimed that it was more important to increase the number of consenting patients rather than to perform OraQuick test.

Park et al.[27] pointed out that problems to be overcome for the OraQuick test include patients' lack of knowledge about HIV testing performed in dental clinics; problems of administration in examination rooms; the burden of the test's cost; difficulties explaining about the test and persuading patients to take it; and medical teams' insufficient abilities to consult upon the delivery of results. Government supports and the efforts of dentists are required to overcome these problems.

The OraQuick test could also be applied usefully in the emergency room. In Korea, it has been reported that among patients visiting the emergency room of university hospitals, 6 to 12 HIV-infected individuals are not detected annually[39,41]. Performing HIV-antibody rapid tests on high-risk patients in the dental clinic as well as emergency room could contribute greatly to the early detection and treatment of infected individuals and improve overall patient survival and quality of life[42].

In the future, Korea, like other countries, must examine the risk rate by performing the OraQuick test on the consisting population in various environments and accumulating data with more comprehensive studies on the population composition. Simultaneously, we must make efforts to detect latent infection and prevent the spread by performing studies on costs and by raising the consent rate.

Conclusions

Numerous studies on the OraQuick rapid HIV test reported in Korea and other countries were reviewed and the following conclusions were obtained:

1. The newly introduced OraQuick test could be performed more readily than conventional methods that use blood, and results can be rapidly obtained, which offers many advantages.

2. In comparison with conventional methods, the OraQuick test is easy, which allows the early detection of infected individuals. If rapid HIV antibody tests using body fluid are performed in places where blood collection is difficult, such as outpatient clinics, dental clinics, the emergency room, and AIDS consultation offices, it would contribute greatly to improved public health. Increased awareness among patients and medical personnel is necessary.

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