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The Use of Saliva in Medical Diagnostics

Katarzyna Van Damme-Ostapowicz *	Department of Integrated Medical Care, Medical University of Bialystok, Bialystok, Poland * Corresponding author
Agnieszka Pedrycz	Department of Histology and Embryology with Laboratory of Experimental Cytology, Medical University of Lublin, Lublin, Poland
Dorota Kaczerska	Department of Clinical Nutrition Medical University of Gdańsk, Poland
Elżbieta Krajewska-Kułak	Department of Integrated Medical Care, Medical University of Białystok, Białystok, Poland
Piotr Siermontowski	Department of Maritime and Hyperbaric Medicine, Military Institute of Medicine, Gdynia, Poland
Krystyna Kowalczuk	Department of Integrated Medical Care, Medical University of Bialystok, Bialystok, Poland

ABSTRACT

For approximately 15 years saliva has been an important element of laboratory diagnostics. Scientists are still looking for modern ways to make use of it in medical diagnostics and the monitoring of therapeutic effects. Advantages associated with the use of saliva in medical diagnostics are multiple. Using saliva as a diagnostic material is non-invasive and painless, and convenient for professionally active adults, elderly patients and young children alike. Saliva may be the perfect diagnostic material and an alternative to routinely used serum, plasma and urine. It is one of the regularly produced biological secretions, containing numerous substances similarly to other fluids, e.g. blood and urine. It seems, however, that its practical use remains underestimated. The availability of saliva as a biological material, and its non-invasive collection method, makes assays of various salivary components increasingly important.

KEYWORDS : saliva, medical diagnostics, evaluation of human health condition

INTRODUCTION

Diagnostic tests performed to evaluate the condition of health or to determine the occurrence of pathological changes are based on laboratory tests of blood and urine (Cavannaugh, 2006). Recent scientific papers indicate a possible use of other fluids, including saliva, tears and sweat for that purpose (Yan et al., 2009).

Saliva is a digestive secretion produced by three pairs of salivary glands: parotid, sublingual and submandibular, and by numerous minor glands located in mucosa of lips, soft palate, tongue and cheeks (Kauffman & Lamster, 2002). The structure of a salivary gland resembles that of another exocrine gland – the pancreas. The base for salivary glands are acini connected with a duct system transporting saliva into the oral cavity. Acini, together with the whole system of ducts, form a functional terminal secretion unit referred to as "salivon". The salivon produces primary saliva, the composition of which becomes altered as it flows through the system of ducts. The final saliva is formed in ducts and excreted into the oral cavity. Salivary glands are innervated by branches of sensory nerves and two types of autonomic nerves - sympathetic and parasympathetic, that via neuromediators trigger the secretory reaction and cause a strong shrinkage of salivary gland blood vessels. Saliva secretion is continuous and is a result of the stimulation of the autonomic nervous system, although some secretory effect may be also observed following the administration of some polypeptides, including the P substance, bradykinin and prostaglandin. Basic average saliva secretion is 0.33 - 0.55 mL/min and is highly variable between individuals, even in standard conditions. Following strong stimulation, e.g. by an alimentary stimulus, saliva secretion may increase up to 1.5 - 2.3 mL/min, and some pharmacological agents, including policarpine and metacholine, reaches as high as 5.0 mL/min. The daily volume of saliva depends on the amount of sleep, frequency and type of meals, emotional stimuli and is on average 1-2 litres. A particular property of saliva is its disproportionally high volume in relation to the weight of the gland, and its low osmolality. Water constitutes 99% of saliva. The remaining percent are inorganic components (sodium, potassium, chlorides, bicarbonates) and organic compounds (proteins, mucins). Saliva osmolality is usually lower than that of plasma, and depends on the level of secretory activity (Cyprysiak & Tadeusiak, 2001). Saliva contains not only the secretion of salivary glands, but also other liquid and cellular components (Bartoszewicz & Kondracka, 2011).

Saliva plays not only a protective function for the oral cavity by the maintenance of a moist environment with buffering properties, but also has an antibacterial and re-mineralising effect and participates in taste sensation, the regulation of water content and blood clotting. The collection of saliva as a diagnostic material is cheap, non-invasive and painless, and convenient for professionally active adults, the elderly and young children alike. (Szydlarska et al., 2008).

Therefore there are several important reasons for which replacing plasma with saliva in diagnostic tests is favourable: saliva is easy to collect, and collection does not require any specialised equipment or trained personnel; saliva may also be collected by the patient himself/herself; saliva may be collected repeatedly throughout the day, in any place, and delivered to a diagnostic lab even by post; saliva collection is not a stress-inducing procedure; saliva may substitute plasma in patients with contraindications or difficulties in blood collection, e.g. in haemophiliacs; saliva is a better material for the analysis of substances whose concentrations are easily altered by stress; saliva may be stored for a week at 4 °C, and for as long as 24 hours in room temperature and be used for the analysis of selected parameters, whereas serum has to be frozen immediately; the costs of analysis of the material are lower compared to serum, considering the less complex procedures at all stages of collection, storage, and delivery to a laboratory (Klichowska-Palonka & Bachenek, 2011)

SALIVA TESTS IN VIRAL DISEASES

Among the salivary proteins there are immunoglobulins: IgA, IgG and IgM. Saliva tests in viral diseases consist in the diagnostics of those antibodies.

Studies have demonstrated that the diagnostics of rotaviral infections in neonates based on salivary IgA is superior to the determination of those antibodies in serum (Jayashree et al., 1988).

The diagnostics of HIV infections in saliva is also reliable and comparable to serum diagnostics. It may be well used in clinical and epidemiological investigations (Klichowska-Palonka & Bachenek, 2011).

Saliva is used as a diagnostic fluid in acute hepatitis type A and B. IgM antibodies present in saliva during that time may be used for the detection of infection and post-vaccination immunity. Saliva may also be used for the determination of infection or post-vaccination immunity of measles, mumps and rubella (Bellini & Helfand).

SYSTEMIC DISEASES CAUSING CHANGES IN SALIVARY GLANDS AND SALIVA

In clinical practice, the compounds which are most often determined in saliva are hormones. A high correlation between saliva and blood hormone concentrations were observed for oestriol, progesterone, testosterone, cortisol and insulin. Changes in saliva composition are accompanied by some organic pathologies, including: glomerular filtration impairment and cystic fibrosis of the pancreas. In coeliac disease, changes in the concentrations of some salivary components were observed, including: total protein, calcium, etc. Diseases such as Sjögren syndrome, bacterial and viral infectious diseases and oral carcinoma cause changes in saliva and blood proteins expression that may be determined as specific biomarkers in the diagnostics of those diseases. Saliva may also be analysed in various infectious diseases, including Helicobacter pylori, Shigella infections and Lime disease (Klichowska-Palonka & Bachenek, 2011).

MEDICATIONS AND DRUGS ASSAYED IN THE SALIVA

Saliva analysis may also be used for the determination of concentrations of some medications, supplying data regarding the free fraction responsible for the pharmacological effects of the therapy. Some medications and drugs that may be assayed in saliva are: antihypertensives, psychotropes, antidepressants, anti-cancer drugs, opioids, amfetamine, barbiturates, halucinogenic preparations, cannabis, alcohol, nicotine (Patsalos et al., 2013).

CONCLUSION

Saliva may be used as a diagnostic material in many fields of medicine. It may be collected in a simple and non-invasive way and the cost of that procedure is low. The procedure does not require skills of a medical staff and a patient may well collect samples by himself at home.

Saliva is an easily available, non-invasive, alternative to blood serum biological material for clinical and laboratory investigations and may be used in the diagnostics of numerous human illnesses.

New applications for saliva tests are discovered every year. Part of them will surely become routinely performed diagnostic tests in medicine in the future.

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