

Comments on the Toothprint® bite impression for search and identification of missing and unknown children: Updated August 2003

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1.) The primary purpose in the development of Toothprints® bite impressions is to record an individual's unique dental characteristics showing the size and shape of the teeth, position of the teeth within the dental arch, and the relationship of the maxillary and mandibular arches to each other.¹ These recordings on the Toothprints® produce an infinitesimal number of possible identifiers which make dental characteristics unique to every individual. Not even identical twins have the same dental characteristics.²

It is well accepted that the incidence of dental caries has significantly declined with resulting decline in the restoration of both primary and permanent teeth. These restorations have historically been the identifiers used in forensic identification of unknown or missing individuals. In fact, 80 percent of permanent teeth affected by dental caries are found in only 25 percent of the children.³ Toothprints® bite impressions would be an extremely important identification tool for children or adults who are caries free. No one would dispute the fact that a properly taken Toothprint® would be a beneficial adjunct to any dental record needed by forensic experts or law enforcement.

2.) Salivary DNA is derived from the constant shedding of epithelial cells from the oral mucosa. Objects remaining in the mouth for any period of time or the rubbing of objects against the tissues of the mouth collect this "salivary DNA." Every law enforcement officer knows that DNA evidence from a salivary source may be on blankets, pillows, sheets, toothpicks, bite marks, bottles, cans, stamps, envelopes, cigarette butts, dental floss, and the list goes on. We do know that saliva collected from a Toothprints® wafer left in the mouth for 50 seconds and rubbing against intraoral tissues would contain a significant amount of genomic or mitochondrial DNA. The scientific literature and news journals have been filled with "cases" of the use of salivary DNA in criminal cases, such as the Parrott case (Canada) in which DNA saliva tests were made from cigarette

¹ Tesini DA, O'Malley KD, Schwartz S, Development of Bite Impression Technique for use in identification of unknown and missing children. J. Mass Dent Society Spring 1985

Tesini DA, Harte DB, Crowley K, Dentistry's role in the identification of missing and unknown children: Update on the dental bite impression technique. J Mass Dent Society 48(2):29, 1999

² Sognaes RF, Rawson RD, Graff M, et al. Computer Comparison of bitemark patterns in identical twins. J Am Dent Assoc. 105:449, 1982

³ Vargas CM, Crall JJ, et al, Sociodemographic Distribution of Pediatric Dental Caries: NHANES III, 1988-1994 JADA 129(Sept) 1229-1238 (1998)

butts collected 10 years after the murder.⁴ The use of any DNA sample over extended periods of time is specific to each case and depends on many factors including extreme environmental conditions (temperature, UV exposure, sunlight, microorganisms, etc.) or contamination from substances which inhibit the analysis procedure⁵. Most recently there has been greater evidence that moisture can affect the quality of a cheek swab DNA sample, and it is recommended that all samples be stored dry⁶. This might also apply to Toothprint® DNA samples and it is suggested that Toothprints® wafers be dry prior to sealing the ziplock bag. A Toothprint® bite impression taken in August 2000 at a Massachusetts Masonic CHIP event was submitted to Genetic Technologies, Inc.⁷ for DNA analysis on June 25, 2003. The Toothprints® wafer had been immediately placed in a ziplock bag and stored unrefrigerated in the home environment by the parents. The Toothprint® was swabbed for analysis in the routine manner as for all forensic samples sent to the company. The results were returned in two weeks showing the full genetic profile of the child. The Toothprints® wafer produced a nuclear DNA genetic profile almost three years after the Toothprint® was taken.

As technology for DNA retrieval and testing is rapidly improving, the sensitivity of the testing will allow for more accurate analysis from even minimal or degraded samples. Likewise, storage of biological samples continues to be researched by law enforcement, forensic science and dental biologists.

3.) There is no agreement as to what the definition of scent is but all agree it is because of chemicals and bacteria in body fluids. Everyone's scent is unique and saliva is known to have a large amount of chemistry and bacteria which account for its use in scent dog tracking. Two national organizations, the National Association of Search and Rescue (NASAR) and the National Association of Police Bloodhounds are the authority on scent dog tracking. We do know that scent remains on the body for up to 109 hours and that saliva is useful even if dried⁸. A scent article for scent dog tracking may be any human by product such as blood or saliva which has been worn, handled or come in contact with the subject. It is important to not contaminate the scent but most experts believe that we cannot mask scent. Dogs have over 200 million scent receiving cells in their nose and are capable of detecting scent molecules at concentrations as low as 10 parts per quadrillion. In one anecdotal "test" (Las Vegas, 2002), that I am aware of, scent dogs were given a month old, dried Toothprint® wafer and were able to locate the individual hiding in a paint closet, on the basement floor in an 8 story building within 10 minutes.⁹ It will vary in each case as to how long the scent from the saliva on the Toothprint® will be

⁴ Toronto Star: DNA links accused to Parrott. Court Told March 5, 1999.

⁵ Sweet, D. The Wide Range of Forensic Dentistry. J of General Dentistry Jan/Feb 2002:8-9

⁶ www.safenetwork.org/DNA_Information, accessed August 13, 2003

⁷ Genetic Technologies, Inc., Glencoe, MO 63038

⁸ Personal Communication - Peter Banks (NCMEC) through his communication with representative of NASAR February 5, 2002

⁹ Personal Communication - Ron Orr, Nevada Masonic ID Program Director, July 2003

useful to any given dog over any given time. In the future, dogs may be specifically scented and trained for saliva tracking.

4.) Law enforcement officials, district attorneys, school boards, missing children organizations, philanthropic organizations, forensic dentists, private dental practitioners, dental hygiene and assisting associations and dental societies have recognized and/or endorsed Toothprints® bite impressions as a means of providing dental identification. Further, the American Academy of Pediatric Dentistry Policy Statement on Child Identification Programs states that “any community identification program should include a dental component.”

As a new tool in biometric identification, we continue to develop bite impressions as a reliable means to record unique dental characteristics and capture saliva for DNA analysis and scent dog tracking.