

STATE OF MICHIGAN
COURT OF APPEALS

PEOPLE OF THE STATE OF MICHIGAN,

Plaintiff-Appellee,

v

SIMON AMINGO WRIGHT,

Defendant-Appellant.

UNPUBLISHED

April 23, 1999

No. 179564

Recorder's Court

LC No. 93-007400

ON REMAND

Before: White, P.J., and Smolenski and R. R. Lamb,* JJ.

PER CURIAM.

In lieu of granting leave to appeal, our Supreme Court has remanded this case to this Court for reconsideration of the issue whether, in light of *Nelson v American Sterilizer Co (On Remand)*, 223 Mich App 485; 566 NW2d 671 (1997) (hereinafter *Nelson II*¹), the trial court erred in admitting the expert testimony of Dr. Allen Warnick, a forensic odontologist, concerning bite marks without conducting a *Davis-Frye*² hearing. After reconsideration as directed by the Court, we find that any error on the trial court's part in failing to hold a hearing was harmless because Dr. Warnick's testimony was admissible under the evidentiary standard enunciated in *Nelson II*.

We begin by briefly summarizing the theory and techniques of bite mark analysis. Bite mark analysis is one of the four main areas of the field of forensic odontology, which, in turn, is defined as the application of the science of dentistry to the field of law.³ "Bite marks are commonly found in food products or on the skin of a victim or an assailant."⁴ Bite marks on a victim occur most frequently in cases involving sexual assault and child abuse and are typically found on the victim's breast, neck, arm, cheek, thigh, buttock or stomach.⁵

The fundamental underlying theory of bite mark analysis is that every person's dentition is unique⁶ and can, therefore, leave a recognizable mark.⁷ When a case involving a bite mark arises, the forensic odontologist begins his analysis by collecting various pieces of evidence. The standard evidence collection technique is to photograph the bite mark pursuant to a known scale so that the photograph can later be enlarged to life size.⁸ Photographs can be taken using black and white, color,

* Circuit judge, sitting on the Court of Appeals by assignment.

infrared or ultraviolet film.⁹ If three-dimensional characteristics are present in the bite mark, the forensic odontologist may make an impression of the bite mark and then make a mold or model of the bite mark from the impression.¹⁰ If the victim is deceased, the forensic odontologist may actually excise and preserve the bite mark.¹¹ The forensic odontologist will also take photographs of the suspected biter's dentition, have the suspect bite into wax or other material in order to register the bite, and take dental impressions of the suspect's teeth from which molds of the teeth can be made.¹²

Once the evidence is collected, the forensic odontologist then uses a variety of comparison techniques to determine to what extent the suspected biter's dentition matches the bite mark. For instance, the forensic odontologist may directly compare the photographs and the models with each other.¹³ "The standard comparison technique of the forensic odontologist is to match a photograph or model of the bite mark to a template of the suspect's dentation through an overlay technique at the same scale."¹⁴ In order to observe three-dimensional characteristics imperceptible to the human eye, the forensic odontologist may also subject the bite mark or the suspect's dentition to scanning electron microscopic analysis.¹⁵ Other comparison techniques include radiographic interpretation, scanning photomacrography, "dusting and lifting" or computerized axial tomographic scanning (CAT scanning).¹⁶

Bite mark comparison evidence is currently admissible in at least thirty-five states.¹⁷

We now turn to the relevant facts of this case, which arises out of the sexual assault and murder of an elderly female who sustained bite marks on her left cheek and each breast. The victim's body was discovered at approximately 9:00 a.m. on August 4, 1992. The next day, Dr. Warnick examined the victim and collected various pieces of evidence with respect to the bite marks on the victim's body. After defendant became a suspect, Dr. Warnick examined defendant in April, 1993, and collected various pieces of evidence with respect to defendant's teeth at this time.

Defendant was subsequently tried for the victim's murder and sexual assault in June, 1994. Before Dr. Warnick testified, defendant moved in limine to preclude Dr. Warnick from specifically testifying about the statistical probability that defendant made the bite marks found on the victim. In support of the motion, defendant contended that the statistical evidence "is a fairly new field" and "is not . . . widely accepted." The trial court denied defendant's motion on the ground that defendant's objection went to the weight to be accorded the evidence by the jury.

Dr. Warnick subsequently testified¹⁸ that during his examination of the victim he charted the bite marks on the victim's body, took black and white and color photographs of the bite marks, made impressions of the bite marks on each breast and made molds of the breast impressions out of diestone and plastic materials.¹⁹ Dr. Warnick testified that after gluing a "special plastic ring" around the victim's right breast for the purpose of supporting the breast tissue, he removed and preserved the victim's right breast "in a five to 10 percent formolin [sic] solution for seven to 10 days."

Dr. Warnick testified that during his examination of defendant he photographed defendant, registered defendant's dentition by having defendant bite into wax, took impressions of defendant's

teeth, and from these impressions made molds of defendant's upper and lower teeth out of diestone and plastic material.

Dr. Warnick testified that each person's dentition is unique and that in this case defendant's teeth exhibited several unusual characteristics. Dr. Warnick then noted that a portion of the biting edge of defendant's upper left central incisor (front tooth) was cracked and that a unique "T" shape had been cut out of the back side of this tooth by some unknown occurrence. Dr. Warnick testified that defendant was also missing the tooth between his upper left central incisor and his upper left lateral incisor. Dr. Warnick also testified that the arch form of defendant's lower teeth was unique in that "it's an oval shape with the teeth on the left of the midline, which I have marked with an arrow are set back, and those on the right side are set forward a bit"

Dr. Warnick testified that he had compared defendant's teeth to the bite marks found on the victim by actually placing the mold of defendant's upper teeth onto the molds of the bite marks on the victim's right and left breast. Dr. Warnick demonstrated this technique for the jury, noting in particular how the mold of defendant's unique upper left front tooth fit into each bite mark mold. Dr. Warnick testified that he had also compared defendant's teeth to each of the bite marks on the victim's body by using an acetate overlay procedure. Dr. Warnick testified that this procedure involved tracing the biting edge of defendant's upper and lower teeth onto clear plastic acetate with an indelible pen and then laying the acetate on top of life-size photographs of the bite marks. Dr. Warnick testified that based on these techniques he had concluded in his April, 1993, police report that the "comparison of the wound pattern injuries found on the [victim] was highly consistent with the dentition found on [defendant]."

Dr. Warnick testified that a couple of months before trial he used a scanning electron microscope to examine the plastic molds of the bite mark on the victim's right breast²⁰ and of defendant's upper teeth. Dr. Warnick testified that he used an electron microscope for the purpose of seeing if the mold of the bite mark on the victim's breast showed the unusual "T" mark and biting edge of defendant's upper left central incisor and the space caused by defendant's missing tooth. Utilizing images taken by the electron microscope that were apparently magnified to eleven times the size of a natural tooth, Dr. Warnick showed the jury how the mold of the bite mark on the victim's right breast contained (1) the "T" shape on the back of defendant's upper left central incisor, (2) the biting edge of this tooth, and (3) the spacing caused by defendant's missing tooth. Dr. Warnick testified on direct examination that in light of his electron microscope analysis he now concluded that "there is no question in my mind that the dentition of [defendant] made the marks on [the victim]."

The following exchange then occurred:

The Prosecutor: What are the chances of this being someone other than [defendant] in this case?

Dr. Warnick: Because of the unique patterns that we have here, especially the area that we were able to visualize with the scanning electron microscope, I feel that there is probably no one in the Detroit Area positively that would be even close to this dentition.

The Prosecutor: What about in the world?

Dr. Warnick: There is an article that was written in 1984 by Doctor Rosen [sic]²¹ in the Journal of Forensic Science that addresses the statistical evidence of the individuality of the teeth.

The Prosecutor: Let me just interrupt you. This article and this person, are you familiar with this person?

Dr. Warnick: Yes, I am.

The Prosecutor: And would it be fair to say that based upon your experience and training in this field that other forensic odontologists recognize this person as an expert in the field?

Dr. Warnick: Yes. He's board certified in forensic odontology. He's one of the pioneers in forensic dentistry.

The Prosecutor: And you have done work in connection with these conclusions and findings that he has made. Correct?

Dr. Warnick: From the standpoint of uniqueness, yes.

The Prosecutor: And based upon your using that article and your professional training as a reference, did you have a conclusion as to the uniqueness of this defendant in terms of the world?

Dr. Warnick: Yes. The article states if you have five unique points, that the chance of another individual making that same mark is 4.1 billion to one. He also states, and this is back from '84. If you had eight points, that no other person in the world would be making this point.

I can say here that with the uniqueness that we found that the Detroit Metropolitan Area is four million. There is no one in that area that would be even close to it. And I would say that there is probably no one in the world that would have this unique dentition.²²

On cross-examination, Dr. Warnick testified that "looking at all the teeth that I have, the uniqueness of it, I feel that it fits into the criteria set up by Doctor Rosen [sic]." Finally, on redirect examination, the following exchange occurred:

The Prosecutor: And in this case you have indicated that it is your expert opinion that it would be virtually impossible for these bites to have been made by anyone other than the defendant?

Dr. Warnick: The distinct, the most distinct point of this dentition is this marking on this breakdown of the back side of this front left tooth. There is no way that another breakdown of this T shape could be formed.

Defendant was subsequently convicted of two counts of second-degree murder and one count of first-degree criminal sexual conduct and sentenced as a fourth-offense habitual offender to fifty-five to one-hundred years' imprisonment. On appeal, we vacated one of defendant's murder convictions as violative of double jeopardy and otherwise affirmed defendant's convictions and sentence, holding, in relevant part as follows:

On appeal, defendant argues that the trial court erred in admitting Dr. Warnick's testimony concerning bite marks, including his testimony with respect to statistical probabilities, without conducting a *Davis-Frye* hearing. We disagree. In *People v Marsh*, 177 Mich App 161, 167; 441 NW2d 33 (1989), this Court held that "the admissibility of a dental witness' bite-mark analysis does not depend on meeting the *Davis-Frye* standard" because "the scientific procedures used, such as x-rays, impressions and photographs, are not novel and . . . may be submitted to the jury to see the comparison for itself." We further conclude that the court did not err in admitting the statistical evidence underlying Dr. Warnick's opinion testimony that defendant was the person who made the bite marks on the victim. The court reasoned that defendant's challenge to the statistical evidence went to the weight the jury could accord this evidence. We agree. See, e.g., *People v Chandler*, 211 Mich App 604, 611; 536; 536 NW2d 799 (1995) (Challenges to DNA statistical evidence are relevant to weight, not admissibility); see also MRE 703; *People v Caulley*, 197 Mich App 177, 195; 494 NW2d 853 (1992) (The policy behind MRE 703 is to allow into evidence all probative facts underlying an expert's opinion, including the opinions of other experts). [*People v Wright*, unpublished opinion per curiam of the Court of Appeals, issued December 3, 1996 (Docket No. 179564).]

Our Supreme Court has now remanded this case to this Court with the following directions:

In lieu of granting leave to appeal, the matter is remanded to the Court of Appeals for it to reconsider the issue whether the trial court erred in admitting Dr. Warnick's testimony concerning bite marks, including his testimony with regard to statistical probabilities, without conducting a *Davis-Frye* hearing. . . . The Court of Appeals should reconsider its decision on this point in light of its decision in [*Nelson II*, *supra*]. After reconsideration, the Court of Appeals is to file its amplified opinion with the clerk of the Supreme Court. Jurisdiction is retained. Court of Appeals No. 179564. [*People v Wright*, 459 Mich 876 (1998) (citations omitted).]

We thus turn to an examination of *Nelson II*. In that case, the plaintiff brought a tort action against various defendants alleging that her exposure to ethylene oxide (EtO) had resulted in her sustaining various injuries, including liver disease (steatohepatitis). *Id.* 487, 499.²³ The trial court proceedings subsequently focused primarily on plaintiff's claim for liver disease. *Id.* at 499. Specifically, plaintiff obtained the services of two expert witnesses who were prepared to testify that in their opinion the plaintiff's liver disease was caused by her chronic low-dose exposure to EtO. *Id.* at 488-489.²⁴ Shortly before trial, the defendants moved in limine to bar the plaintiff's experts from testifying.²⁵ The defendants contended that the experts' opinion testimony concerning the cause of plaintiff's liver disease was not supported by the data on which the experts relied.²⁶ Following a hearing, the trial court agreed with the defendant, ruling that the plaintiffs' experts could not testify on the issue of causation because the experts' proposed opinion testimony lacked sufficient scientific grounding. *Id.* at 487. The trial court then dismissed the plaintiff's tort action in its entirety. *Id.*

This Court affirmed the dismissal of the plaintiff's claim for liver disease but reversed the dismissal of her claims for other injuries. *Id.* at 498-499. With respect to the claim for liver disease, this Court found that dismissal was warranted because the trial court had properly ruled that the plaintiff's experts could not testify on the issue of causation and without such testimony the plaintiff could not establish a prima facie case. *Id.* at 498. For our purposes in this case, the crux of *Nelson II* is the analysis this Court used in determining that the trial court had properly ruled that the plaintiff's experts could not testify on the issue of the cause of the plaintiff's liver impairment. Specifically, this Court first enunciated the legal principles that would guide its resolution of the evidentiary issue:

The question whether chronic inhalation exposure to EtO causes steatohepatitis in humans is scientific in nature, and it is to the scientific community that the law must look for the answer. For this reason, the expert witnesses are indispensable in this case. But that is not to say that the trial court's hands were inexorably tied, or that it must have accepted uncritically any sort of opinion espoused by either party's proffered experts merely because their credentials rendered them qualified to testify. To the contrary, under the rules of evidence, the trial court was charged with ensuring that any and all scientific testimony to be admitted was not only relevant, but also reliable. *Amorello v Monsanto Corp*, 186 Mich App 324, 331-332; 463 NW2d 487 (1990). See *Kelley v Murray*, 176 Mich App 74, 79; 438 NW2d 882 (1989).

The primary source of this obligation is MRE 702, which clearly contemplates some degree of regulation of the subjects and theories about which an expert may testify. The degree of discretion this evidentiary rule affords a trial court is at the heart of the resolution of the question now before this Court.

A

MRE 702 provides, in pertinent part, that if "*recognized scientific . . . knowledge* will assist the trier of fact to understand the evidence or to determine a fact in issue," then an expert "may testify *thereto*." (Emphasis added.) Accordingly, MRE 702 restricts the subject of an expert's testimony to "*recognized scientific . . .*

knowledge.” There are no Michigan appellate cases that expressly construe the phrase “recognized scientific knowledge.” Some guidance may be taken, however, from *Amorello, supra*.

In *Amorello, supra* at 332, this Court opined that the facts and data upon which an expert relies in formulating an opinion must be reliable. The Court then concluded that the plaintiffs had failed to demonstrate the admissibility of the opinion testimony of their expert to the effect that PCB exposure caused the plaintiffs’ health problems because the plaintiffs’ had failed to offer evidence to rebut the defendants’ claims that the testimony did not have a reasonable medical or reliable scientific basis and was unsupported by scientific and medical literature. *Amorello, supra* at 331-332.

We also take guidance from an application of the rules of construction to the phrase “recognized scientific knowledge.” The interpretation of a court rule is subject to the same principles that govern statutory construction. *Michigan Basic Property Ins Ass’n v Hackert Furniture Distributing Co, Inc*, 194 Mich App 230, 234; 486 NW2d 68 (1992). All words and phrases are to be construed and understood according to the common and approved usage of the language. *In re Public Service Comm’s Determination, No 2*, 204 Mich App 350, 353; 514 NW2d 775 (1994). Reference to a dictionary is appropriate to ascertain the ordinary meaning of a word. *Popma v Auto Club Ins Ass’n*, 446 Mich 460, 470; 521 NW2d 831 (1994).

The word “recognized” connotes a general acknowledgment of the existence, validity, authority, or genuineness of a fact, claim, or concept. Black’s Law Dictionary (6th ed), p 1271; *Webster’s New World Dictionary, Third College Edition*, p 1121. The adjective “scientific” connotes a grounding in the principles, procedures, and methods of science. *Id.*, p 1202; *Daubert v Merrell Dow Pharmaceuticals, Inc*, 509 US 579, 590; 113 S Ct 2786; 125 L Ed 2d 469 (1993).²⁷ Finally, the word “knowledge” connotes more than subjective belief or unsupported speculation. *Id.* at 590. The word ““applies to any body of known facts or to any body of ideas inferred from such facts or accepted as truths on good grounds.”” *Id.*, quoting *Webster’s Third New International Dictionary*, p 1252 (1986).

We conclude that MRE 702 requires a trial court to determine the evidentiary reliability or trustworthiness of the facts and data underlying an expert’s testimony before that testimony may be admitted. To determine whether the requisite standard of reliability has been met, the court must determine whether the proposed testimony is derived from “recognized scientific knowledge.” To be derived from recognized scientific knowledge, the proposed testimony must contain inferences or assertions, the source of which rests in an application of scientific methods. Additionally, the inferences or assertions must be supported by appropriate objective or independent validation based on what is known, e.g., scientific and medical literature. This is not to say, however, that the subject of the scientific testimony must be known to a certainty. *Daubert, supra* at 590. As long as the basic methodology and principles employed by

an expert to reach a conclusion are sound and create a trustworthy foundation for the conclusion reached, the expert testimony is admissible no matter how novel. *Id.* at 596; see *Richardson v Richardson-Merrell, Inc.*, 273 US App DC 32, 41; 857 F2d 823 (1988). [*Nelson II*, *supra* at 489-492.]

After reviewing the scientific data (in vivo animal studies) underlying the plaintiff's experts' proposed causation opinion testimony, the *Nelson II* Court concluded that "none of the scientific data upon which plaintiff's experts rely furnishes a scientifically valid basis for the conclusion they would draw":

Both of plaintiff's causation experts have opined that plaintiff's steatohepatitis was caused by chronic low-dose exposure to EtO. None of the animal studies relied on by these experts report, however, an association between chronic low-dose exposure to EtO and liver disorders in animals. Additionally, one of plaintiff's experts testified that the pathophysiology of plaintiff's liver disease was consistent with a hyper-sensitive reaction to EtO. None of the studies relied upon by plaintiff's experts report or address hyper-sensitive reactions in animals. Neither plaintiff nor her experts provide any understandable scientific basis for establishing the value of directly extrapolating human conclusions from the findings of the animal studies upon which they rely. Accordingly, in the absence of any evidence that chronic low-dose exposure or hypersensitivity in to EtO caused liver disease in animals, and in the absence of histologic findings of liver injury or disease in animals exposed to EtO of a similar or identical nature to the disease exhibited by plaintiff, the deductions of plaintiff's experts that chronic low-dose exposure or hypersensitivity to EtO causes liver disorders of any kind in humans do not rest in an application of scientific methods. Nor are these deductions supported by scientific or medical literature. Accordingly, plaintiff has failed to demonstrate that her experts' opinion testimony was derived from recognized scientific knowledge as required by MRE 702. The trial court did not err in granting defendants' motion in limine and barring plaintiff's experts from providing causation testimony concerning plaintiff's liver disease. . . . [*Id.* at 497-498 (citations omitted).]

Thus, we believe our task on remand is to determine whether, in light of *Nelson II*, the trial court erred in admitting Dr. Warnick's testimony concerning bite marks, including his testimony with regard to statistical probabilities, without conducting a hearing to determine whether the facts and data underlying Dr. Warnick's testimony met the requisite standard of reliability under MRE 702, i.e., whether Dr. Warnick's testimony was derived from recognized scientific knowledge.

We initially note that although defendant made various objections to Dr. Warnick's testimony, the only objection by defendant that conceivably implicated the admissibility standards of either the *Davis-Frye* rule or MRE 702 went to Dr. Warnick's specific testimony concerning statistical probabilities. In light of *Nelson II*, we hold that the trial court erred in failing to conduct a hearing to determine whether Dr. Warnick's testimony concerning statistical probabilities was derived from recognized scientific knowledge. However, defendant did not make an objection that implicated the admissibility standards of either the *Davis-Frye* rule or MRE 702 with respect to Dr. Warnick's other

testimony concerning both the fundamental theory underlying bite mark analysis (that every person's dentition is unique) and the various comparison techniques (electron microscope analysis, acetate overlay procedure, mold comparisons) used in this case. We do not read *Nelson II* as requiring a trial court to sua sponte hold a hearing whenever scientific knowledge is offered by a party but no objection is made by the opposing party. Rather, in *Nelson II*, the defendants specifically objected to *any* testimony by the plaintiff's experts on the issue of causation.²⁸ Thus, with respect to Dr. Warnick's other testimony to which defendant made no objection that raised the admissibility standards of the *Davis-Frye* rule or MRE 702, it would appear that the trial court did not err in failing to hold a hearing to determine whether this testimony was derived from recognized scientific knowledge.

Alternatively, in the context of determining the admissibility of scientific evidence under FRE 702, the United States Supreme Court in *Daubert*,²⁹ *supra* at 592, n 11, stated:

Indeed, some theories that are so firmly established as to have attained the status of scientific law, such as the laws of thermodynamics, properly are subject to judicial notice under Federal Rule of Evidence 201.

In *Wilt v Buracker*, 191 W Va 39, 46; 443 SE2d 196 (1993), the court concluded that “*Daubert* is directed at situations where the scientific or technical basis for the expert testimony cannot be judicially noticed and a hearing must be held to determine its reliability.” We believe that *Nelson II* likewise is directed at situations where the scientific basis for expert testimony cannot be judicially noticed and a hearing must be held to determine the reliability of the evidence. In light of *Marsh*, the cases cited therein and the cases from numerous other jurisdictions³⁰ that have found admissible testimony analogous to Dr. Warnick's testimony, excluding his testimony concerning statistical probabilities, it would appear that the reliability of Dr. Warnick's general testimony could be judicially noticed. MRE 201; *Meyerhoff v Turner Construction Co (On Remand)*, 210 Mich App 491, 494; 534 NW2d 204 (1995), vacated in part on another ground 456 Mich 933 (1998). Thus, with respect to Dr. Warnick's testimony, excluding his testimony concerning statistical probabilities, it would again appear that the trial court did not err in failing to hold a hearing to determine the reliability of this testimony.

However, given that we have already concluded that the trial court erred in failing to conduct a hearing to determine whether Dr. Warnick's testimony concerning statistical probabilities was derived from recognized scientific knowledge, we will likewise assume that the trial court also erred in failing to hold a hearing to determine whether Dr. Warnick's other testimony was derived from recognized scientific knowledge. The question arises then whether the error was harmless. In determining whether the error was harmless, we will consider whether Dr. Warnick's testimony was admissible because it was derived from recognized scientific knowledge.

In this respect, we note that although bite mark evidence is admissible in at least thirty-five states, such evidence remains controversial.³¹ The fundamental theory underlying this evidence—that every person's dentition is unique—is not accepted by all and critics complain that “there is little research establishing the unique nature of a human bite mark.”³² However, the underlying theory that every person's dentition is unique certainly rests in an application of the scientific methods of dentistry. *Nelson II*, *supra* at 491. Moreover, the Rawson³³ article relied on by Dr. Warnick during his testimony

provides objective and independent validation for this theory. *Id.* Specifically, in this article, Rawson describes a study in which twelve-hundred bite samples of six maxillary and six mandibular anterior teeth were collected. Rawson *et al.*, *Statistical Evidence For The Individuality Of The Human Dentition*, 29 J Forensic Sciences 245, 246 (1984). The X and Y coordinates of the center point for each tooth was determined and recorded as was the angle of rotation for each tooth, and this information was entered into a computer software program specially designed to give information compatible with “the standard Statistical Package for the Social Sciences” *Id.* at 249. The initial sample size of twelve-hundred bite marks was screened to produce a final sample size of 384, which was then increased to 397 to test observer error. *Id.* Rawson notes that “[t]he sample may be considered to be small in comparison to the population of the world, but it has been designed to represent a general cross section of the United States and it follows arithmetic indicators for sample size.” *Id.* at 249-250. Rawson also notes that “[d]iscriminate function analysis demonstrated no statistically significant indicators of race, age, or sex.” *Id.* at 250. Rawson concludes:

By determining the actual number of positions that each tooth type can occupy, the mathematics of probabilities become factual determinations rather than theoretical considerations. The minimum number of positions of the X center point, the Y center point, and the angle in which any one tooth type can be found is 150 for Tooth 6. The greatest number of positions is found for Tooth 9 at 239. By using 150 as the number of positions for all teeth the statistical calculations will follow the most conservative case. The probability of finding two sets of dentition with six teeth in the same position, plus or minus 1 mm for center point and plus or minus 5° angle difference, is 150 to the sixth power or 1.4×10 to the 13th. The actual total probability can be calculated by multiplying the individual probabilities. There are various positions that may have higher probabilities individually, but the total number of positions for the maxillary arch would then be the product of the individual positions of $150.0 \times 161.5 \times 165.9 \times 173.9 \times 239.9 \times 132.7 = 2.2 \times 10$ to the 13th and the mandibular arch is $107.2 \times 204.0 \times 116.0 \times 153.5 \times 150.4 \times 103.5 = 6.08 \times 10$ to the 12th. The total positions of twelve teeth is calculated to be 1.36×10 to the 26th. The population of the world is listed at over four billion, which would only require an accurate match of five teeth in a bite mark case to have confidence that there would be no other set of teeth capable of producing the same mark. Therefore, the concordance of eight specific tooth marks to eight specific teeth would very safely be considered as characteristic or unique for a single person. One would have great confidence that no other person was capable of producing the same marks.

Summary and Conclusions

This paper is a study of the individuality of the human dentition by the use of a precise registration of that dentition into another material. The technique is thus appropriate for the calculations of individuality as well as actual bite mark investigation if there is a mark on skin or other material of sufficient quality to allow proper measurements. There have existed two major concerns in the field of forensic

odontology to date. First, there is a concern over uniqueness. Is the human dentition unique enough to say that there are no two sets of dentition alike? This mathematical evaluation of a general population sample demonstrates the uniqueness of the human dentition beyond a reasonable doubt, thus placing the odontologist's statements about individuality beyond the realm of theory and into the realm of supported fact. The problem of uniqueness of the human dentition should now be of less concern than the second problem of whether there is a representation of that uniqueness in the mark found on the skin or other inanimate object.

The real concern now is the determination of the match between the dentition and the impression or bruising of the skin or other material. If the correlation is high between the dentition and the mark then there can be an assurance that no other set of teeth could have caused the mark, and that assurance can be justified as long as the individual tooth marks are within a ± 1 mm by center point and a $\pm 5^\circ$ angle variation of each individual tooth.

Although those standards are strict, the author has worked on criminal cases where there has been that degree of representation. Those measurements appear to be within the limits of actual observation. The direction of the future will be to test the observational limits and to develop a better understanding of the distortion that is often seen in actual bite mark cases. [*Id.* at 251-253.]

We thus conclude that the underlying theory of bite mark analysis on which Dr. Warnick's testimony was based (that every person's dentition is unique) was sound and created a trustworthy foundation for his conclusion that defendant was the person who made the bite marks on the victim. *Nelson II*, *supra* at 492.

With respect to the various comparison techniques employed by Dr. Warnick, it has been noted that

forensic odontologists still face two major problems in making accurate bite mark comparisons: distortion of the receiving surface during biting, and distortion of the bite mark itself when reproducing it for comparison purposes.

First of all, skin is very elastic and is a poor receiving surface. Bite marks in skin tend to change their shape and size over time due to bleeding, swelling, and shrinking of the wound area. Bite marks left in foodstuffs and other materials can also change their size and shape, depending on the hardness and consistency of the material. In addition, a bite mark is often not an accurate representation of the teeth that causes the impression because of the bite dynamics involved. For example, skin can get dragged or stretched between the teeth prior to the bite impression, and multiple teeth marks can become superimposed on one another. Furthermore, the bite mark will usually only include a limited number of the assailant's teeth. Thus, the forensic odontologist seldom has a complete, undistorted bite mark to examine.

Secondly, even if a relatively undistorted bite mark is left behind by a criminal, an inexperienced crime scene investigator may distort the bite mark when attempting to reproduce it for later comparison to a suspect's dentition. For example, if photographs of the bite mark are not taken perpendicular to the bitten surface, some distortion on the out edges of the photographed bite can result.³⁴ Even when a bite mark impression (mold) is made directly from the victim's skin, distortion may result if the mold material shrinks during the hardening process. As a result of the above problems, the forensic odontologist may not have an accurate bite mark model for comparison purposes.³⁵

In addition, using dental wax or Styrofoam to produce templates "can introduce errors due to differences in the physical properties of skin and wax or Styrofoam."³⁶

However, in *McGrew v State*, 682 NE2d 1289 (Ind, 1997), the Indiana Supreme Court considered the admissibility of hair comparison evidence under Indiana Evidence Rule 702(b), which provides that

"[e]xpert scientific testimony is admissible only if the court is satisfied that the scientific principles upon which the expert testimony rests are reliable." [*Id.* at 1290.]

The court concluded that the hair comparison evidence was admissible at defendant's criminal trial:

In the present case, we conclude that the trial court exercised appropriate discretion as to the reliability of the proffered hair comparison analysis. The analyst testified that the hair comparison he performed was a comparison of physical characteristics, as seen under a microscope. Inherent in any reliability analysis is the understanding that, as the scientific principles become more advanced and complex, the foundation required to establish reliability will necessarily become more advanced and complex as well. The converse is just as applicable, as demonstrated by the trial court's conclusion that "what we're talking about is not the traditional scientific evaluation. We are talking about simply a person's observations under a microscope." Record at 632. The conclusion is not unlike our recent statement in [*Jervis v State*, 679 NE2d 875 (Ind, 1997)] that the evidence at issue was more a "matter of the observations of persons with specialized knowledge" than "a matter of 'scientific principles' governed by Indiana Evidence Rule 702(b)."³⁷ [*McGrew, supra* at 1292.]

We do not read *Nelson II* as setting an inflexible standard for the admissibility of scientific evidence under MRE 702. Rather, we believe that the determination of admissibility under MRE 702 depends on the nature of the scientific evidence at issue. Unlike the scientific methodology of disease causation at issue in *Nelson II*, as well as the procedures involved in other forms of scientific testing, such as DNA analysis, the bite mark comparison techniques employed by Dr. Warnick do not involve near total reliance on scientific interpretation to establish a question of fact. Rather, like the hair comparison techniques in *McGrew*, the jury is able to see the bite mark comparisons for itself by comparing the photographs, molds and other physical evidence. We conclude, therefore, that the observational bite mark comparison techniques employed by Dr. Warnick were sound and created a

trustworthy foundation for his conclusion that defendant was the person who made the bite marks on the victim. We further conclude that any limitations with respect to the various comparison techniques used by Dr. Warnick in this case were properly the subject of cross-examination.

Finally, in light of the Rawson article, we conclude that Dr. Warnick's testimony concerning statistical probabilities rested in an application of the scientific method of statistics and was supported by objective and independent validation. *Nelson II*, *supra* at 491. We find this case entirely distinguishable from the use of statistics found to be erroneous in *People v Collins*, 68 Cal 2d 319; 438 P2d 33; 66 Cal Rptr 497 (1968). Accordingly, we conclude that the statistical analysis employed by Dr. Warnick was sound and created a trustworthy foundation for his conclusion that, in light of the fact that defendant's dentition fit within the criteria set forth in the Rawson article, there was no one in the metropolitan Detroit area of four million persons, and probably the world, that would have the same dentition as defendant. *Nelson II*, *supra* at 492.

In summary, it is clear that the subject of bite mark analysis is not known to a certainty. *Id.* at 491-492. However, we conclude the facts and data underlying Dr. Warnick's conclusion that defendant was the person who made the bite marks on the victim were derived from recognized scientific knowledge. *Id.* at 491; see also *State v Sager*, 600 SW2d 541, 561, 569, 573 (Mo App, 1980) (concluding after examining authoritative text materials by experts in the field that forensic odontology, including bite mark identification, is an exact science and that an expert opinion can be postulated as an aid to the courts when acceptable techniques and procedures are used). Dr. Warnick's testimony was thus admissible under MRE 702. Because Dr. Warnick's testimony was admissible under MRE 702, the trial court's error in failing to hold a hearing in this regard did not affect the verdict and was, therefore, harmless. *People v Graves*, 458 Mich 476, 487; 581 NW2d 229 (1998).

/s/ Michael R. Smolenski

/s/ Richard R. Lamb

¹ This Court's original decision in *Nelson*, 212 Mich App 589; 538 NW2d 80 (1995) (hereinafter *Nelson I*), was subsequently vacated in part and remanded to this Court. See 453 Mich 943 (1996).

² The *Davis-Frye* rule was adopted from *People v Davis*, 343 Mich 348; 72 NW2d 269 (1955), and *Frye v United States*, 54 US App Dc 46; 293 F 1013 (1923), superseded by statute as stated in *Daubert v Merrell Dow Pharmaceuticals, Inc.*, 509 US 579, 587; 113 S Ct 2786; 125 L Ed 2d 469 (1993). The rule limits the admissibility of novel scientific evidence by requiring the party seeking to introduce such evidence to establish that it has achieved general scientific acceptance for reliability, as supported by disinterested and impartial experts in the particular field. See *People v Lee*, 212 Mich App 228, 262; 537 NW2d 233 (1995); *People v Haywood*, 209 Mich App 217, 221; 530 NW2d 497 (1995).

³ Note, *Bite Mark Evidence: Forensic Odontology And The Law*, 2 Health Matrix: J of Law-Medicine 303, 304 (1992). The other three main area of the field of forensic odontology are (1) dental identification of the unknown body; (2) oral injuries, and; (3) dental malpractice. *Id.*

⁴ Comment, *Odontology: Bite Marks As Evidence In Criminal Trials*, 11 Santa Clara Computer & High Technology L J 269, 271 (1995).

⁵ Comment, n 4 *supra* at 272.

⁶ The human dentition consists of

thirty-two teeth, each with five anatomic surfaces, for a total of one hundred and sixty combinations. In addition, a person's teeth can have a number of individual characteristics, caused by restorations, prosthesis, decay, malposition, malrotation, spacing, arrangement, wear patterns, breakage, fillings, and bite relationship. [Tesdaahl, *Bite Mark Evidence: Making An Impression In Court*, 1989-July Army Lawyer 13, 14.]

⁷ Note, *Forensic Dentistry And The Law: Is Bite Mark Evidence Here To Stay?*, 24 Am Crim L Rev 983 (1987).

⁸ Tesdahl, n 6 *supra* at 15.

⁹ Tesdahl, n 6 *supra* at 15.

¹⁰ Comment, n 4 *supra* at 274; Note, n 3 *supra* at 308-309.

¹¹ Rothwell, *Bite Marks In Forensic Dentistry: A Review Of Legal Scientific Issues*, 126 J Am Dental Association 223, 227 (1995). As explained further:

To preserve the bite mark and allow for prolonged study, scientists have developed a procedure for removing the bitten tissue from the body of a deceased victim. This is accomplished by the use of the Acrylonitrile-Butadiene-Styrene plastic ring (ABS ring). Information can be obtained on deceased persons by carefully removing the tissue inflicted with the bite mark. However, it is extremely difficult to maintain the anatomical configurations of the skin and body contours. The ABS ring supports the configurations and contours before and after removal from the body. The technique is explained as convenient, easy, and adaptable to most surface areas, such as the breast, scalp and abdomen. [Comment, n 4 *supra* at 278.]

¹² Rothwell, n 11 *supra* at 227-228; Comment, n 4 *supra* at 274.

¹³ Tesdahl, n 6 *supra* at 15.

¹⁴ Note, n 3 *supra* at 309. The suspected biter's teeth, or a model thereof, are pressed into a chosen medium, such as wax, Styrofoam or the skin of the victim or another person of similar physical characteristics. Comment, n 4 *supra* at 279; Note, n 3 *supra* at 311 and 323, n 62. The templates are

then created by using acetate overlay tracings, photography or radiographic techniques. Note, n 3 *supra* at 323, n 62.

¹⁵ Comment, n 4 *supra* at 277.

¹⁶ Comment, n 4 *supra* at 276-280. Radiographic interpretation penetrates tissue to reveal damage not readily observed by standard photography procedures. *Id.* at 276. Scanning photomacrography “uses a series of illuminator-lamps that are able to project a thin, adjustable light beam on the object to be photographed.” *Id.* at 278. Finally, dusting and lifting, much like fingerprinting, “enables investigators to life tooth prints off the surface of both alive and deceased victims.” *Id.*

¹⁷Note, n 3 *supra* at 303; see also *Howard v State*, 701 So 2d 274, 293 (Miss, 1997) (Smith, J., dissenting) (citing cases from numerous jurisdictions in which bite mark evidence has been found to be admissible).

¹⁸ Except where otherwise specifically noted, our recitation of Dr. Warnick’s testimony is a summary of the points made by Dr. Warnick during his entire testimony on direct, cross-, redirect and recross-examination.

¹⁹ We note that the various prosecutorial exhibits prepared by Dr. Warnick, including dental molds and photographs, were provided to this Court during defendant’s initial appeal to this Court, but have not been provided to this Court on remand.

²⁰ Dr. Warnick apparently used two plastic molds of the victim’s right breast for his electron microscopic analysis, one that was made from the original impression of the right breast before it was excised and preserved and a second that made from a second impression of the right breast after it was excised and preserved.

²¹ The article referred to by Dr. Warnick was Rawson *et al.*, *Statistical Evidence For The Individuality Of The Human Dentition*, 29 J Forensic Sciences 245 (1984).

²² Analogous testimony concerning the Rawson article and statistical probabilities was also elicited from Dr. Warnick on cross- and redirect examination.

²³ See also *Nelson I*, n 1 *supra* at 590.

²⁴ See also *Nelson I*, n 1 *supra* at 591.

²⁵ *Nelson I*, n 1 *supra* at 591.

²⁶ *Nelson I*, n 1 *supra* at 591.

²⁷ In *Daubert*, the United States Supreme Court held that the general acceptance test enunciated in *Frye*, *supra*, was superseded by the Federal Rules of Evidence (FRE). *Daubert*, *supra* at 587; see

also note 2, *supra*. The *Daubert* Court further held that the admissibility of scientific evidence is primarily controlled by FRE 702. *Daubert, supra* at 589. This rule of evidence provides as follows:

If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise. [FRE 702.]

The *Daubert* Court stated that when faced with a proffer of scientific expert testimony a trial court must determine under FRE 702 whether “the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue.” *Id.* at 592. The *Daubert* Court explained that the phrase “scientific knowledge” establishes a standard of evidentiary reliability that is grounded on scientific validity. *Id.* at 590. The *Daubert* Court further explained that a trial court must therefore examine whether “the reasoning or methodology underlying the testimony is scientifically valid” *Id.* at 590, 592-593. The Court then enumerated a nonexhaustive list of factors a trial court should balance in order to determine whether a theory or technique is scientifically valid: (1) whether the theory or technique can be and has been tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) the known or potential rates of error of the theory or technique, and (4) the extent to which the theory or technique has been widely accepted. *Id.* at 593-594. The Court emphasized that the overarching inquiry is the scientific validity of the principles and methodology underlying the proposed testimony, not the conclusions that such principles and methodology generate. *Id.* at 594-595.

In *People v McMillan*, 213 Mich App 134, 137, n 2; 539 NW2d 553 (1995), and *Lee, supra* at 261, n 17, this Court rejected suggestions that the *Davis-Frye* standard be replaced with the “more relaxed” *Daubert* standard on the ground that this Court is required to follow the *Davis-Frye* standard until our Supreme Court overrules or modifies its decisions on this issue.

Finally, we note that MRE 702 contains a different standard than FRE 702. Specifically, FRE 702 applies to “scientific . . . knowledge” while MRE 702 applies to “recognized scientific . . . knowledge.”

²⁸ *Nelson I*, n 1 *supra* at 591.

²⁹ See note 27, *supra*.

³⁰ See note 17, *supra*.

³¹ Rothwell, n 11 *supra* at 223, 226; Comment, n 4 *supra* at 270.

³² Comment, n 4 *supra* at 283; see also Rothwell, n 11 *supra* at 229.

³³ See note 21, *supra*.

³⁴ It has also been stated that photographing a bite mark produces an inherently distorted representation because photography reduces a three-dimensional object to a two-dimensional display. Note, n 7 *supra* at 993.

³⁵ Tesdahl, n 6 *supra* at 14.

³⁶ West *et al.*, *The Use Of Human Skin In The Fabrication Of A Bite Mark Template: Two Case Reports*, 35 J of Forensic Sciences 1477 (1990).

³⁷ Indeed, in light of the distinction made in *McGrew*, it could be argued that the bite mark comparison techniques used in this case by Dr. Warnick likewise involve “recognized . . . technical, or other specialized knowledge,” MRE 702, to which *Nelson* is inapplicable. However, for purposes of our analysis we assume that Dr. Warnick’s comparison techniques involve scientific knowledge subject to *Nelson*.