Bilateral versus unilateral mandibular block anesthesia in a pediatric population

Courtney College, DDS, MS Robert Feigal, DDS, PhD Angela Wandera, BDS, MS Malcolm Strange, DDS, MSD

Dr. College and Dr. Strange are in private practice, Wheat Ridge, Colorado and Evergreen, Colorado; Dr. Feigal is an associate dean for Graduate Programs and Facilities, and professor of Dentistry and Dr. Wandera is a clinical assistant professor of Dentistry, Department of Pediatric Dentistry, University of Michigan. Correspond with Dr. College at ccollege@worldnet.att.net

Abstract

Purpose: This prospective study aimed to evaluate unilateral versus bilateral mandibular nerve block anesthesia with regard to post-operative soft tissue trauma and other complications in a pediatric population.

Methods: A total of 320 patients age 2 to 18 years were appointed for routine operative treatment. There were no age, gender, behavior, or general health exclusions. Oral and written post-operative instructions were given to parents, as well as a survey preview. A phone survey was conducted after treatment to determine a number of variables, including soft tissue trauma.

Results: A total of 13% of all patients experienced post-operative soft tissue trauma. By age group, trauma frequency was 18% (<4 yrs.), 16% (4-7 yrs.), 13% (8-11 yrs.) and 7% (>12 yrs.). Comparing unilateral versus bilateral subjects as to trauma revealed that in the <4 age group trauma was higher for the unilateral subjects (35% vs. 5%, P<.02). Non-significant trends showed increased trauma in unilateral groups at ages 8-11 and >12 years.

Conclusion: This study represents the first documentation of post-anesthetic soft tissue trauma prevalence in a pediatric population. The results reveal no contraindication to the use of bilateral mandibular block anesthesia. (Pediatr Dent 22:453-457, 2000)

Dentistry is an evolving field, constantly changing as new techniques and methods are introduced. It is important to justify practice methods through science, rather than simply historical precedent. There are many areas in dentistry where treatment protocol was dictated based on empirical reasoning alone and promulgated in textbooks over the years. One of the most germane tools to the practice of dentistry, the techniques employed in administering local anesthesia, have been universally accepted without much controversy since local anesthetics were first introduced. It is true that investigators have derived new injection techniques to add to the dentist's armamentarium and that improvements have been made in the composition of local anesthetic. However, indications for the use of local anesthetic have remained relatively static since they were presented in the earliest dental textbooks. Of specific interest to this study, most authors and clinicians have never accepted the routine use of bilateral mandibular block anesthesia. The literature cites a multitude of reasons that this particular combination of injections is contraindicated in patients of any age; concerns such as loss of proprioception, lip and cheek biting trauma, and "swallowing the tongue" are most commonly mentioned.[1,2] Treatment is routinely planned around the avoidance of bilateral mandibular block anesthesia, a precaution that has been instilled in dentists early in dental school training. The philosophy of unilateral mandibular treatment often leads to additional appointments scheduled. If a child is anxious about going to the dentist, multiple visits can exacerbate that anxiety. These same patients often could be treated in one sitting if the dentist were to employ bilateral mandibular nerve block anesthesia.

There is very little mention of bilateral mandibular block anesthesia in the dental literature. An article addressing the concerns associated with bilateral mandibular injections in adults studied the control of the tongue and speech in 36 patients who had been given bilateral inferior alveolar and lingual nerve blocks for oral surgery.[3] The patients in this study did not object to bilateral mandibular anesthesia. Patients maintained the ability to move the tongue in any direction requested and showed no tendency to bite the tongue, and no difficulty in enunciation after they adapted to the numbness sensation. Adatia and Gehring drew several conclusions from the results of this study, including that the trauma risk to the tongue following bilateral inferior alveolar and lingual nerve block, "... is apparently unlikely to be any greater than that associated with unilateral block. Previous clinical experience of this procedure in several hundred cases allows a similar conclusion."

A 1992 survey of Florida dentists routinely treating children in their dental practices reported that 30% of respondents "...would administer bilateral inferior alveolar nerve blocks when indicated."[4] This correlates with another finding in the survey, in which practitioners reported that in 76% of children's appointments, only one quadrant of dentistry was completed. More than one quadrant was restored only 24% of the time. Although the focus of this survey was to generally determine local anesthesia practices among a small regional population of dentists who routinely treated children, the willingness to bilaterally anesthetize the mandible when necessary by 30% of respondents indicates that there is a discrepancy between what is contained in textbooks and what is employed in clinical practice. Recently, the avoidance of bilateral mandibular block anesthesia was questioned in the literature. It was listed as myth number 7 in an article titled "Eleven myths of dentoalveolar surgery."[5]

Received March 29, 2000 Revision Accepted September 20, 2000

The purpose of this study was to compare the incidence of soft tissue trauma and other postoperative complications between unilateral and bilateral mandibular nerve block anesthesia in a pediatric population. The Null hypothesis stated that there would be no difference in soft tissue trauma between the 2 groups. Furthermore, this study was designed to determine whether or not there are contraindications to anesthetizing bilateral mandibular quadrants in the same appointment when treatment needs exist in both quadrants.

Methods

Establishing a baseline

An extensive review of the literature revealed no published incidence nor estimate of frequency of soft tissue trauma following injection of local anesthetic. In order to obtain an estimate of the sample size necessary for this study, an informal survey of 24 pediatric dentists was conducted. Dentists were asked to record years of practice experience and to estimate the incidence of soft tissue trauma associated with local anesthesia. Estimated incidence of soft tissue trauma ranged from one to 10%, with a calculated average of 4%. Two power calculations at 80% power were then performed: one to determine the sample size required assuming a 9% difference in trauma frequency from unilateral versus bilateral injections, and the other to determine the sample size required to detect a 2% difference in frequency. The sample size necessary to show statistical significance given a 2% difference in the frequency of soft tissue trauma (N=1604) was recognized as unattainable within the time constraints of this research project, while a 9% difference could be determined with N=160. The assumption was made that clinically significant conclusions could be drawn given a realistic sample size of 150 subjects per group, a number which would also reveal statistical significance if there existed a large difference in the incidence of soft tissue trauma between unilateral and bilateral groups.

Table I. Relative Frequencies of Several Demographic, Treatment and Surveyed Patient Variables

Parameter	Measure	Frequency	Percentage
State	Colorado	225	70
	Michigan	95	30
Gender	female	167	52
	male	153	48
Anesthetic type	2% lidocaine	310	97
	2% mepivacaine	10	3
Additional anesthetic	no	312	98
	yes	8	2
Sedation	no	302	94
	yes	18	6
Special care patient	no	318	99
	yes	2	1
Behavior	acceptable	287	90
	unacceptable	33	10
First meal	<1 hour	49	15
	1-3 hours	173	54
	>3 hours	98	31
Drooling problem	no	270	84
	yes	50	16
Speech difficulty	no	217	68
	yes	103	32
Soft tissue trauma	no	277	87
	yes	43	13
Other complications	no	283	88
	yes	37	12
Accepted treatment	no	57	18
	yes	263	82

Subjects

Patients in the study were from the Hurley Pediatric Dental Clinic in Flint, Michigan; the University of Michigan Graduate Pediatric Dentistry Clinic in Ann Arbor, Michigan; and the private practice of a pediatric dentist in Wheat Ridge, Colorado. Written consent was obtained from those parents who elected to participate according to IRB approval. Any child planned for operative treatment requiring mandibular block anesthesia was eligible for participation, regardless of the nature of treatment to be provided. In order to obtain the largest sample size possible, there were no age, gender, behavior, or general health exclusions. Two separate treatment groups were examined; the control group received unilateral mandibular block anesthesia, while the experimental group received bilateral mandibular block anesthesia.

Each child was placed in the control or the experimental group based on the location of the necessary dental treatment. All patients requiring restoration of only one mandibular quadrant were automatically placed in the control group. Age, gender, and behavioral information was recorded for each subject. Mandibular inferior alveolar and long buccal local nerve block anesthesia was administered prior to dental treatment, with anesthetic type, location, and quantity recorded on the data sheet. No patient received more than the maximum recommended dose of local anesthetic. The 2 types of local anesthetic utilized during this study were 2% lidocaine HCl (Astra Pharmaceutical and generic brands) with 1:100,000 epinephrine, and 2% mepivacaine HCl (Astra Pharmaceutical) with 1:20,000 levonordefrin.

Both written and oral post-operative instructions were given to parents and patients. Parents also left the office with a preview of the survey questions to be asked on the phone, so that they would know what specifically to observe in their child post-operatively. Soft tissue trauma was defined on the survey as redness and/or swelling on the lip, cheek or tongue. Other survey questions included whether speech or drooling difficulties were experienced, time of first meal after treatment, and the parent's subjective opinion as to whether or not their child accepted the numbness sensation. Within 2 days following the dental appointment, the first attempt at contacting the parent

by phone was made by either the principal investigator or the respective office manager, and the questionnaire was completed. Not all parents were successfully contacted within two days. Often multiple attempts were required before successfully contacting the responsible parent or guardian. The majority of data collection was completed within a week following the child's dental appointment. A total of 6 patients were dropped from the study because they could not be reached by phone. All of those who were successfully contacted by phone were included in the study. No parent or legal guardian declined to answer the survey questions once contacted. In those instances where there was a significant delay in contacting the parent or guardian, it was first confirmed that they readily recalled the patient's postoperative experiences.

Statistical analyses

Frequencies of distribution of age group, gender, sedation, special needs, behavior problem, site of treatment, trauma, and other complications were examined. Chi Square analyses were utilized to compare incidence of trauma in each of these subgroups and to compare other trends within the population of patients. Subjects were divided into one of 4 age groups, and Chi Square analysis was used to evaluate any differences among age groups.

Results

The 320 subjects were nearly evenly divided between gender, with 48% male and 52% female (Table I). Most of the subjects were obtained from the Colorado practice (70%), while 30% were from the Michigan clinics. Only 18 patients, or 6%, were sedated, and even fewer, 1%, were special needs patients. The overwhelming majority of patients were anesthetized with 2% lidocaine with 1:100,000 epinephrine (97%), while only 10 were treated using 2% mepivacaine with 1:20,000 levonordefrin. One hundred seven patients, or 33%, were anesthetized in both the maxillary and mandibular dentitions during the treatment appointment. A very small number of patients, 3%, required supplemental injection in order to obtain profound anesthesia. Subjects ranged in age from 18 months to 18 years, and they were divided into 4 age groups to analyze possible trends within groups. Thirty-eight patients (12%) were less than 4 years of age, 121 patients (38%) were from 4 through 7 years of age, 93 patients (29%) were from 8 through 11 years of age and 68 patients (21%) were in the 12 and over age group.

Subjects were evenly divided into experimental and control groups, with 51% of patients receiving unilateral mandibular anesthesia and 49% of patients receiving bilateral mandibular anesthesia. An even distribution was also seen when patients were grouped by age, such that each age group had a relatively equal number of unilateral and bilateral patients.

Some patients (16%) experienced drooling, and almost one third (32%) had some difficulty with speech after treatment. Almost 70% of patients ate their first meal within 2 hours after the appointment. A total of 43 patients (13%) experienced post-operative soft tissue trauma from either unilateral or bilateral mandibular anesthesia. There were 57 patients (18%) whose parents did not feel that their child favorably accepted the numbness sensation, regardless of whether it was on one or both sides of the mandible, while 82% of patients were reported to have had no problems with the numbness sensation either during or after treatment.

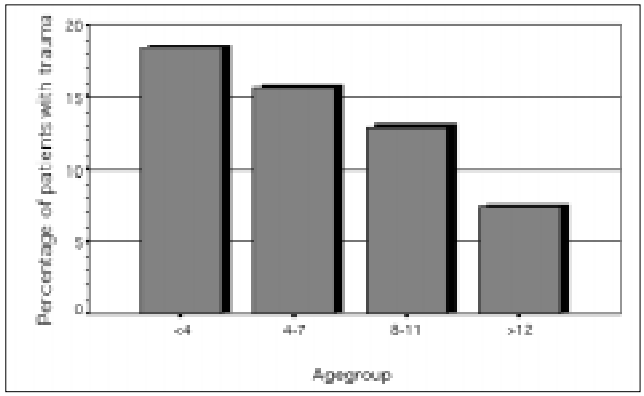

Fig 1. Overall incidence of trauma in each age group.

There were no statistically significant correlations between the prevalence of soft tissue trauma and any of the parameters surveyed. Anesthetic type, amount, and additional sites of injection did not effect the prevalence of trauma. In fact, 16% of patients without maxillary injections reported trauma, compared to 9% in patients who had been anesthetized in at least one maxillary quadrant in addition to the mandible. Patients who were sedated showed no greater tendency for soft tissue trauma, with only one of the 18 sedated patients reporting self-induced trauma. There was 21% trauma frequency in the unacceptable behavior patient subgroup , and 13% frequency in the acceptable behavior group.

The overall frequency of trauma was 13%, with variation by age group. The highest percentage was reported in patients less than 4 years old (18%), and the frequency decreased as age increased. In patients from 4 through 7 years old, trauma was reported 16% of the time, those from 8 through 11 reported 13%, and those 12 years of age and older,7%. These results are summarized in Figure 1. The trauma group was examined with regard to site of mandibular local anesthesia. Sixteen percent of the 163 unilateral mandibular anesthesia patients experienced soft tissue trauma, while 11% of the 157 bilateral mandibular anesthesia patients reported the same. When examined by age group, there was also a higher percentage of trauma from unilateral anesthesia than bilateral anesthesia in 3 of the age groups, with the exception of those from 4 through 7. The percentage of soft tissue trauma was greater in bilaterally anesthetized children in this age group. Specific trauma site frequency by age group and anesthetic site is illustrated in Figure 2. Statistical significance was found in the incidence of reported trauma in the under 4 age group. Of the 18% with self-induced soft tissue trauma, one patient in this subgroup was anesthetized bilaterally, and 6 were anesthetized on one side only. The difference in site of trauma was statistically significant for this youngest age group (P=.02).

Discussion

This study serves as the first reported data on complications of mandibular nerve block anesthesia in pediatric patients. The data show that the frequency of soft tissue trauma after administration of local anesthetic was higher than expected, with no statistically significant differences in the frequency of trauma between unilateral and bilateral groups overall. However, when

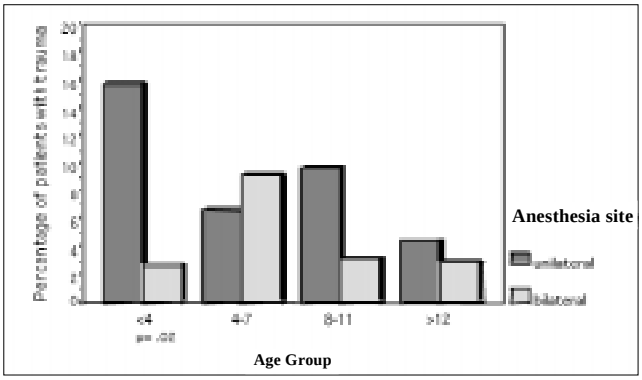

Fig 2. Percentage of trauma reported in unilateral and bilateral injection sites for each age group.

separate age groups were examined, the youngest children experienced significantly more trauma following unilateral mandibular anesthesia than bilateral mandibular anesthesia (P=.02). There was an overall higher frequency of soft tissue trauma in the youngest age group, regardless of whether anesthesia was administered to one or both sides of the mandible. None of the parameters evaluated were found to be associated with soft tissue trauma post-operatively. Parents' perceptions of the acceptance of mandibular anesthesia was of little value in predicting trauma. Almost all parents felt that their child favorably accepted the numbness sensation (82%), even if their child experienced self-induced trauma after the appointment. The 57 parents who did not think that their child accepted the numbness sensation were primarily from the non-trauma group (86%), while only 14% of those who did not accept the sensation of profound anesthesia actually experienced untoward traumatic effects on the soft tissues.

Subjects were not evenly distributed among age groups. The majority of patients fell into the 4 through 7 age group, followed by the 8 through 11 group and the 12 and over category. The youngest age group was the smallest in number but yielded the most dramatic results. The small number of patients in this age group (38) necessitates caution in interpreting the results. For example, the sole report of trauma in the bilaterally anesthetized patient from this group represented a 5% incidence of trauma within the subpopulation, because 21 patients in this age range were anesthetized bilaterally.

There were a total of 18 patients treated with conscious sedation, totaling less than 6% of the study population. Chloral hydrate (50-65 mg/kg) and promethazine (0.5-1.0 mg/kg) were used for sedating patients. All but 4 of sedated patients were less than 4 years old. This might be expected, as conscious sedation is particularly useful in younger children. There was only one incidence of soft tissue trauma in the sedated group, and that child was in the 4 through 7 age group. In this isolated incidence of trauma associated with sedation, the child had been anesthetized bilaterally. Although sedation represents a potentially confounding variable, removing sedated patients from the general population would greatly reduce the subject size in the youngest age group. Clinical observation shows that sedated patients tend to be groggy and want to sleep immediately after treatment. A sleeping patient might have less tendency to explore intraoral sensations with tongue and teeth. If this was the case, it could be argued that sedated patients should be analyzed as a separate entity. The statistical significance seen in the site of trauma described above would then be nullified, as 14 of the 38 patients in that age group would be relocated into the sedation group. A separate analysis could be accomplished only with a much larger sample size, expounding on this study and looking specifically at young children.

The overwhelming majority of patients were treated after administration of 2% lidocaine, and less than 4% were anesthetized with 2% mepivacaine. There was no difference in any of the parameters when they were evaluated separately, therefore they were grouped together throughout the analyses. Treatment time also varied greatly, from 15 to 140 minutes, but the length of treatment did not appear to have an effect on the incidence of trauma in the sample population. Over 95% of appointments were completed within 90 minutes, and the majority within 60 minutes. Given that intraoral soft tissue local anesthesia lasts approximately 2 hours regardless of appointment length, it might be expected that a child with a short appointment would be numb for a longer period post-operatively. A child with a longer appointment, where more than one quadrant of the mouth is treated, is under the direct supervision of the dental team for a greater percentage of the duration of anesthesia. Soft tissue trauma is effectively prevented by this direct supervision while the child is in the dental office. All patients in this study receiving bilateral mandibular anesthesia required dental treatment in both mandibular quadrants, which is generally indicative of a longer appointment when compared to unilateral treatment.

The frequency of trauma was much higher than what surveyed pediatric dentists had anticipated. This discrepancy can be attributed in part to the fact that parents often fail to mention minor postoperative trauma unless specifically questioned about it at a subsequent visit, while major soft tissue trauma, defined by swelling and/or mutilated tissue, might prompt a parental phone call to the office. However, when the follow-up phone call is initiated by the dentist's office and the parent is asked specifically about the child's recovery, it is evident that children experience soft tissue trauma much more frequently than expected.

There was a trend toward a greater frequency of trauma in those patients anesthetized on one side of the mandible only, which might be counterintuitive. A child's perception of the soft tissue anesthesia sensation might play a role in this difference in reported trauma. A child who is anesthetized on both sides of the mandible may perceive that his/her soft tissues feel different, but they are equally different on both sides. Unilaterally anesthetized children, on the other hand, do not have that feeling of symmetry, and might be more apt to explore the side that feels "different" or "strange" after a dental appointment. Testing of the numbness sensation with one's teeth could lead to tissue mutilation on that side. Of the patients from 4 through 7 years of age, a greater number experienced trauma bilaterally than unilaterally. This is the only age group in which the trauma frequency is reversed. In contrast to the youngest age group, these children are of school age, and if treatment was rendered in the morning, they were more than likely returned to school after their appointments. It is possible that there was less post treatment supervision at school, explaining a slightly greater frequency of soft tissue trauma.

It is possible that by providing a written copy of the questions in advance, parents were sensitized to expected outcomes, resulting in an unusually high incidence of reported trauma and

related complications. This was considered at the onset of the project, and it was decided that the benefit of informing parents of recovery expectations in advance exceeded the risk of reported trauma related to treatment and not recovery. To eliminate this variable in future studies, it would be beneficial to appoint a calibrated, blinded evaluator to perform an intraoral exam within 2 to 3 days of treatment. Parents could answer subjective questions about patient recovery, but an objective observer would note location and severity of any trauma resulting from local anesthesia during a quick follow-up visit to the office. The additional appointment inconvenience might increase the attrition rate, requiring a larger initial sample size.

Overall, Chi square analyses revealed no significant difference in the incidence of soft tissue trauma between unilaterally and bilaterally anesthetized groups. The similarity in frequency of soft tissue trauma between the two groups indicates one of several possibilities: there were not enough subjects in this study to detect a statistically significant difference, there truly was no detectable difference in soft tissue trauma post-operatively, or the differences were masked by the wide age range of patients in this study. Three hundred and twenty pediatric patients were included, and previously performed power calculations indicate that this sample size would have revealed a statistically significant difference in reported trauma, at 80% power, given a 9% difference in frequency. Therefore, the difference in frequency of soft tissue trauma, if one does exist, must be less than 9%. Within the conditions and findings of this study, there is no significant clinical risk in treating a child requiring 2 quadrants of mandibular treatment in one visit with bilateral mandibular nerve block anesthesia.

Conclusions

1. Observed frequency of soft tissue trauma was found to be much higher than predicted by surveyed, experienced pediatric dentists.
2. Frequency of post anesthesia soft tissue trauma was higher in young patients and decreased with age.
3. There was no significant difference in the incidence of trauma between bilateral and unilateral groups. In fact, there was a tendency for patients anesthetized in both mandibular quadrants to experience less soft tissue trauma than the unilateral control group.
4. In relation to post-operative soft tissue trauma and patient/parent report of subjective factors, there is no contraindication to the use of bilateral inferior alveolar nerve block anesthesia in a pediatric population when treatment needs dictate.

References

1. Malamed SF: Handbook of Local Anesthesia, 3rd Ed. St. Louis: Mosby Year Book, 1997, pp. 1-48.
2. Mathewson RJ, Primosch RE: Fundamentals of Pediatric Dentistry. Chicago: Quintessence Publishing Co., 1995, pp. 166-79.
3. Adatia AK, Gehring EN: Bilateral inferior alveolar and lingual nerve block. Br Dent J 133(9): 377-83, 1972.
4. Cheatham BD, Primosch RE, Courts FJ: A survey of local anesthetic usage in pediatric patients by Florida dentists. ASDC J Dent Child 59(6): 401-7, 1992.
5. Alexander RE: Eleven myths of dentoalveolar surgery. J Am Dent Assoc 129: 1271-79, 1998.

STATEMENT OF OWNERSHIP, MANAGEMENT, AND CIRCULATION (Required by 39 U.S.C. 3685). 1. Publication Title: Pediatric Dentistry. 2. Publication Number: 0164-1263. 3. Filing Date: September 18, 2000. 4. Issue Frequency: bimonthly. 5. Number of Issues Published Annually: 7. 6. Annual Subscription Price: Institutional $175; Individual $120. 7. Complete Mailing Address of Known Office of Publication: 211 East Chicago Avenue, Suite 700, Chicago, IL 60611-2663. 8. Complete Mailing Address of Headquarters or General Business Office of Publisher: American Academy of Pediatric Dentistry, 211 East Chicago—Suite 700, Chicago, IL 60611-2663. Contact Person: Dr. John Rutkauskas. Telephone: 312-337-2169. 9. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor: Publisher—American Academy of Pediatric Dentistry, 211 East Chicago Avenue, Suite 700, Chicago, IL 60611-2663; Editor—Milton I. Houpt, DDS, PhD, 211 East Chicago Avenue, Suite 700, Chicago, IL 60611-2663; Managing Editor—None. 10. Owner: American Academy of Pediatric Dentistry, 211 East Chicago Avenue, Suite 700, Chicago, IL 60611-2663. 11. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities. None. 12. Tax Status: Has not Changed During Preceding 12 months.

13. Publication Title: Pediatric Dentistry 14. Issue Date for Circulation Data Below: September/October 2000

15. Extent and Nature of Circulation	Average No.Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
a. Total Number of Copies (*Net Press Run*)	5,388	5,300
b. Paid and/or Requested Circulation		
(1) Paid/Requested Outside-County Mail Subscriptions Stated on Form 3541. (*Include advertiser's proof and exchange copies*)	4,983	5,102
(2) Paid In-County Subscriptions (*Include advertiser's proof and exchange copies*)	0	0
(3) Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Non-USPS Paid Distribution.	0	0
(4) Other Classes Mailed Through the USPS	0	0
c. Total Paid and/or Requested Circulation [*Sum of 15b. (1), (2), (3), and (4)*]	4,983	5,102
d. Free Distribution by Mail (*Samples, complimentary, and other free.*)		
(1) Outside-County as Stated on Form 3541	0	0
(2) In-County as Stated on Form 3541	35	35
(3) Other Classes Mailed Through the USPS	0	0
e. Free Distribution Outside the Mail (*Carriers or other means*)	0	0
f. Total Free Distribution (*Sum of 15d. and 15e.*)	35	35
g. Total Distribution (*Sum of 15c. and 15f.*)	5,018	5,137
h. Copies not Distributed	370	163
i. Total (*Sum of 15g. and h.*)	5,388	5,300
j. Percent Paid and/or Requested Circulation (*15c. divided by 15g. times 100*)	99%	99%

16. Publication of Statement of Ownership is required. It will be printed in the Nov/Dec 2000, issue of this publication.

17. Signature and Title of Editor, Publisher, Business Manager, or Owner

John S. Rutkauskas, Executive Director Date: 9/18/00

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).