

# The T.O.V.A. Times



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## Are You Doing All You Can for Patients on Medication?

*If someone offered you a way to improve patient care, give parents greater peace of mind, and even increase clinical revenue, would you take it?*

What if you've already got it? How closely do you follow patients who are taking stimulant medication? Kids grow. Frontal lobes mature, and medication needs can change over time. Are your patients still on the right dose? **How will you know if you don't check?**

When you repeat off- and on-medication T.O.V.A. sessions at regular intervals, you get continuing, empirical evidence of medication responsiveness. You'll also know when medication adjustments might be necessary.

In his clinical practice, Dr. Lawrence Greenberg, creator of the T.O.V.A. and University of Minnesota Professor Emeritus of Child and Adolescent Psychiatry, found that repeated T.O.V.A. testing every six to nine months ensured continued optimal medication dosing and provided invaluable peace of mind for caregivers.

Parents appreciate that you care enough to do more than a brief "check-in" once or twice a year. Objective data from the T.O.V.A. reassures them, and with their peace of mind comes **additional referrals.**

We're entering uncertain economic times. Using the T.O.V.A. helps make your work stand out. Why not use every tool you've got to support your practice?

For more information on how you can build your practice with the T.O.V.A., call the TOVA Company at 1-800-PAY-ATTN to schedule a free, 15-minute consultation with Dr. Lawrence Greenberg, creator of the T.O.V.A., or with Dr. Steve Hughes, pediatric neuropsychologist, Director of Education and Research for The TOVA Company, and Assistant Professor of Pediatrics and Neurology at the University of Minnesota Medical School (Call soon - lunchtime slots go first!).

What to know more? Take a look at Dr. Greenberg's article, [Use of the T.O.V.A. in the Diagnosis and Treatment of Attention Disorders.](#)

## Harnessing the Power of Across-Test Comparisons

How can I show a parent that their child is responding to treatment? What medication or dose works best for this patient? Has the patient's off-medication performance changed over time? All of these questions can be addressed by comparing the results of multiple T.O.V.A. administrations, and there's an easy way to do so. In fact, you can compare the results of up to four T.O.V.A. administrations using the T.O.V.A. Compare Tests report. It's built-in, and easy to do! Here's how it works.

Let's say you want to compare results from a first visit "baseline" to results from three additional T.O.V.A. tests given at stages through a course of neurotherapy or a behavioral treatment program, and then to a final post-treatment result demonstrating maintenance of improvement after treatment.

From the T.O.V.A. File menu, select "Open..." and then pick the baseline T.O.V.A. session from the session list. Next, in the same way (using the File/Open... command) select the first mid-treatment T.O.V.A. session, the second mid-treatment session, and finally the post-treatment session. All four reports are now stored in memory, ready to be combined.

From the Interpretation menu, now select "Compare tests." The T.O.V.A. will produce a single report page, showing comparison bar graphs for RT Variability, Response Time, Commission Errors and Omission Errors. Using the Compare Tests report, you can really show the patient's response to treatment!

Before you produce a T.O.V.A. test comparison report, you should give some thought to how you want your data to be presented, as the graphs on the comparison report page are arranged in the order that you load the T.O.V.A. data files. Generally, if you want to show improvement over time, you'll load the files in the order with which the tests were administered. However, if you want to show multiple on- and off-medication comparisons, you might consider loading two off-medication T.O.V.A. sessions first, and then two on-medication sessions, just to highlight the differences.

Up to four interpreted T.O.V.A. tests can be compared in a single test comparison report. Look for more on the importance of comparing auditory and visual T.O.V.A. tests in a future edition of *The T.O.V.A. Times*.

The T.O.V.A. Compare Tests report is a great way to show your patient's history of performance, and a fantastic tool to help demonstrate changes across time or conditions.

Let us know how you use the 'Compare Tests' report! Contact us by email, phone, or fax today.

## Understanding and Interpreting Anticipatory Errors

Occasionally you'll see T.O.V.A. segments (usually quarter 3 or quarter 4) that the T.O.V.A. scoring algorithm has flagged as invalid due to the subject having made excessive "anticipatory errors." The bar graphs for these segments look different, and the standard scores for affected quarters, halves, and total are flanked by square brackets.

While these results are described as "invalid," this does not mean that your T.O.V.A. is not usable! Understanding what an anticipatory error is, why the T.O.V.A. program flags it, and what it means will help you understand what is happening with your patients.

What is a "guess" and what is not? How do the limits of human reaction time help us understand the difference? The mere fact that the subject produced excessive anticipatory responses tells you some important things about their response style! See the following special report on anticipatory errors.

## Making Sense of Anticipatory Errors

*We've all seen them: brackets around the standard scores in quarters 3 or 4. The T.O.V.A. reports that scores in quarter 3 or 4 are "Invalid due to excessive anticipatory errors," and the standard scores for Half 2 and the Total are also flagged as invalid. What does all this mean, and is it possible to get useful information from a T.O.V.A. with these "invalid" scores? The short answer is Yes! Read on for a full explanation of how anticipatory errors occur, and how you can use them to learn about your patients!*

In this article, we'll discuss anticipatory responses, review how they can impact T.O.V.A. results, and provide some tips on how to interpret a test that has one or more invalid quarters due to the occurrence of excessive anticipatory responses.

To start things off, let's first review some information about T.O.V.A. anticipatory responses and where they occur during a T.O.V.A. session. Figure 1 presents the time line for a T.O.V.A. trial.

From start to finish, a T.O.V.A. trial is exactly 2000 milliseconds long. The portion in light blue shows the 100 millisecond interval during which the stimulus is being presented, and the portion in red indicates the 350 millisecond interval during which any response made by the subject is flagged as "anticipatory."

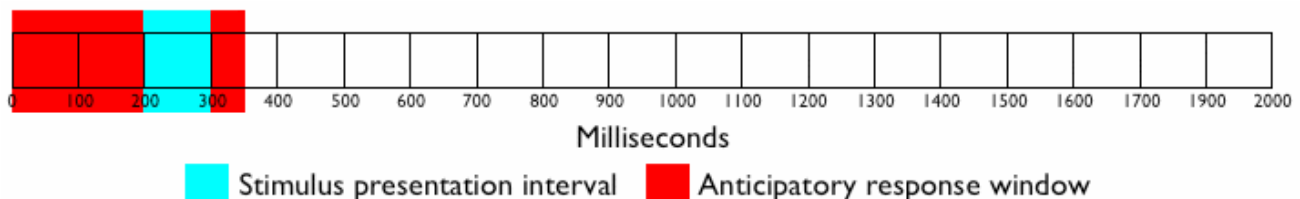


Figure 1. Timeline of a T.O.V.A. trial.

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Most people assume that a T.O.V.A. trial begins with presentation of the target or nontarget stimulus, but as you can see, the "clock" actually starts 200 milliseconds (ms) before a stimulus is presented. Responses that are made during that 200 ms pre-stimulus interval, or the 100 ms interval during which the stimulus is displayed, or up to 50 ms after the stimulus disappears, are flagged as "anticipatory" and excluded from further analysis.

You can probably guess why responses made prior to the stimulus are considered "anticipatory," but why are responses made during and just after stimulus presentation also treated this way?

The reason has to do with how quickly humans are able to respond to a stimulus. Research on human reaction time shows that we cannot produce a simple motor response in reaction to a stimulus in less than about 130 milliseconds.

The T.O.V.A. is measuring a more complex kind of response. The subject must observe the stimulus, determine whether or not it is a target, and then click the button. This requires additional mental processing, and we extend the "anticipatory response" window to include the period 150 ms from the start of the stimulus presentation to take account for this. Any response made during that interval is almost certainly an impulsive "pre-perceptual" one. Thus, even correct responses made during this interval are considered to be errors, made without the opportunity to actually evaluate the stimulus.

Anticipatory responses are quite rare during Half 1 of the T.O.V.A. but become more common during Half 2, the frequent target condition, especially during Quarter 3.

Since most of the trials in Half 2 present target stimuli, it is important that anticipatory responses (even if they are "lucky guesses") be excluded from analysis. If we didn't, the subject could get a remarkably high score just by quickly clicking blindly during each trial—they'd almost always be correct!

As you can imagine, excluding trials with anticipatory responses does have some impact in our analysis algorithms. Removing trials with anticipatory responses reduces the total number of errors counted for commission errors, and also reduces the amount of data available for the calculation of response time and response time variability. This can affect standard scores in non-obvious ways. Those brackets are the T.O.V.A.'s way of informing you that the subject made an excessive number of anticipatory responses during that quarter, that calculation of the standard scores did not include those trials, and that you should interpret the affected standard scores carefully (they may not be an accurate reflection of the subject's performance or ability).

It is also important to recognize that an "invalid" quarter does not necessarily mean there is no information for you. Indeed, the very fact that anticipatory errors have occurred is telling you something! It is the more impulsive among us who are most prone to making these errors! The mere fact that the subject produced excessive anticipatory responses tells you about their response style.

Let's look at an example case. Below you can see the results of a visual T.O.V.A. from a boy, age 8 years, 10 months who was referred for an evaluation because of concerns regarding his attention:

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<b>Variable</b>	<b>Q1</b>	<b>Q2</b>	<b>Q3</b>	<b>Q4</b>	<b>H1</b>	<b>H2</b>	<b>Total</b>
RT Variability	97	75*	62*	[99]	84b	[79]	[79]
Response Time	94	95	99	[102]	94	[101]	[99]
Commission Errors	106	105	108	[105]	106	[107]	[108]
Omission Errors	104	97	94	[97]	101	[95]	[96]
<b>ADHD Score = [-2.73]</b>							

If you're a seasoned T.O.V.A. user, you've probably already observed an interesting pattern of performance across the four quarters in his RT Variability. His performance appears to deteriorate over time, but suddenly becomes normal in Quarter 4, which has also been flagged as "invalid" due to excessive anticipatory errors. The rest of his performance is fairly unremarkable; response time remains relatively stable, as do commission and omission errors. So what is the deal with the "anticipatory error" brackets?

In this case, the presence of the "invalid" fourth quarter, even in the face of the normal range standard scores, is telling.

Here is what is going on. The subject became increasingly inconsistent in his response speed, indicating that his engagement is wavering. He is not making excessive omission or commission errors, but his performance is "unsteady." We often see subjects like this end up making excessive errors near the end of the test as they become "impatient" with the test, and this often manifests as impulsive responding (so a low score on Commission errors). Given the good standard scores in quarter 4, that doesn't appear to be the case - or is it?

Reflect for a moment on what causes anticipatory responses. These are responses made before the subject could have been able to accurately perceive and evaluate the stimulus. In a very real sense, anticipatory responses are a kind of "super-fast Commission error."

What has our subject begun doing in quarter 4? He's made many responses that are within the anticipatory response window, many "super-fast commission errors". These anticipatory errors are not included in the calculation of the standard scores and because of this, his performance looks pretty good if we ignore the brackets. The brackets are there to tell us that we should not trust these average-range scores, and in fact the worst elements of the subject's performance have been "trimmed out" by the anticipatory response detector.

So what do we have? We saw his variability decline, and his performance really did not normalize in quarter 4. In fact, it became worse, but his excessive, extremely fast and impulsive responses all occurred during the "anticipatory response" interval and were not factored into score calculations.

We hope you understand why it is important to identify and account for anticipatory responses, and we hope you understand that "invalid" does not mean "not useful." In fact, if you remember what those brackets are trying to tell you, there is no reason to be disappointed by tests with invalid quarters. Think: *"Lots of super-fast commission errors!"*

*Have questions about this article or anything else about the T.O.V.A.? Contact us! Write to [info@tovatest.com](mailto:info@tovatest.com), or give us a call at 1-800-PAY-ATTN. And thanks for being a T.O.V.A. user!*

## **Request For Information on T.O.V.A. and TBI or PTSD**

If you are a T.O.V.A. practitioner and you are working with TBI or PTSD, we would love to hear from you. We are gathering information on how the T.O.V.A. is used in the assessment and monitoring of these conditions as well as different treatment approaches and their successes. Please e-mail us at [info@tovatest.com](mailto:info@tovatest.com) with a brief description of your work or your contact information. You may also call us at 1-800-PAY-ATTN to tell us about your work. We appreciate your help in compiling this much needed information.

## **Upcoming Workshops and Conferences**

This month, The TOVA Company will present one-day workshops about ADHD and the T.O.V.A. in these locations:

[Portland, OR on April 9th, 2009](#)

[Amsterdam, NL on April 17th, 2009](#)

Space is limited, so [sign up today!](#)

And don't forget to come visit our booth at [APA in May in San Francisco!](#)