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The GH-Method

Viscoelastic Medicine Theory (VMT #339): An Improvement of VMT-Based Prediction of 17 Cases of Diseases or Symptoms versus Multiple Tiers of Multiple Influential Causes Using the "Forced Initial Condition" Based on GH-Method: Math-Physical Medicine (No. 939)

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Abstract

Starting from January 2021, the author has integrated the advanced engineering's space-domain viscoplastic energy model (SD-VMT) into his medical research efforts. With a specific focus on this VMT methodology, he has authored a total of 339 research papers to date. During his recent 20 studies, he has observed that the equation he developed for predicting output symptoms of diseases based on the VMT energy ratios achieved 100% prediction accuracy. However, there were variations in waveform correlations (R) between his metabolism index (MI)-based output and VMT-predicted output. This discrepancy was due to a kind of "abnormal" numerical operations that resulted in a different initial output value from the VMT model compared to the initial output value from the MI-based output value. To address this numerical issue, the author has decided to use the MI-based initial output as the initial VMT-based output at "time-zero". Upon reviewing his recent 20 SD-VMT analyses with the VMT-predicted output, the author selected 17 cases for a sensitivity study using this "forced initial condition". The purpose of this particular article is to re-calculate those 17 prediction accuracies and 17 waveform correlations for these 17 cases using the new algorithm with the "forced initial condition". The author would like to note that readers can refer to his previous original papers for those original prediction accuracies and waveform correlations without the "forced initial condition". In summary, this study presents three significant observations: 1. When comparing the VMT analysis results with the "forced initial condition" versus without, the "new with" case exhibited an average prediction accuracy of 99%, whereas the averaged prediction accuracy for the "old without" cases was 100%. 2. Out of the total 17 cases with different waveform correlations, the "new with" case achieved a correlation of 66% compared to 52% for the "old without" cases. However, when considering only the 13 cases with positive correlations, the "new with" case showed a correlation of 83% while the "old without" case had a correlation of 82%. 3. In conclusion, the "new with forced initial condition" cases resulted in a 1% decrease in prediction accuracies compared to the "old without" cases, but they exhibited a 14% higher correlation for all 17 cases or a 1% higher correlation for the 13 cases with positive correlations. Thus, sacrificing 1% of prediction accuracy in order to gain a 14% improvement in waveform correlation is a worthwhile endeavor.

Keywords: Viscoelastic; Viscoplastic; Diabetes; Exercise; Metabolism index

Abbreviations: MI: metabolism index; CVD: cardiovascular diseases; CKD: chronic kidney diseases; T2D: type 2 diabetes; PPG: postprandial plasma glucose; FPG: fasting plasma glucose

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1. INTRODUCTION

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During his recent 20 studies, he has observed that the equation he developed for predicting output symptoms of diseases based on the VMT energy ratios achieved 100% prediction accuracy. However, there were variations in waveform correlations (R) between his metabolism index (MI)-based output and VMT-predicted output. This discrepancy was due to a kind of "abnormal" numerical operations that resulted in a different initial output value from the VMT model compared to the initial output value from the MI-based output value. To address this numerical issue, the author has decided to use the MI-based initial output as the initial VMT-based output at "time-zero".

Upon reviewing his recent 20 SD-VMT analyses with the VMT-predicted output, the author selected 17 cases for a sensitivity study using this "forced initial condition". The purpose of this particular article is to re-calculate those 17 prediction accuracies and 17 waveform correlations for these 17 cases using the new algorithm with the "forced initial condition".

The author would like to note that readers can refer to his previous original papers for those original prediction accuracies and waveform correlations without the "forced initial condition".

2. METHODS

2.1 MPM background

To learn more about his developed GH-Method: math-physical medicine (MPM) methodology, readers can read the following three papers selected from his published 760+ papers.

The first paper, No. 386 describes his MPM methodology in a general conceptual format. The second paper, No. 387 outlines the history of his personalized diabetes research, various application tools, and the differences between biochemical medicine (BCM) approach versus the MPM approach. The third paper, No. 397 depicts a general flow diagram containing ~10 key MPM research methods and different tools.

2.2 The author's diabetes history

The author was a severe T2D patient since 1995. He weighed 220 lb. (100 kg) at that time. By 2010, he still weighed 198 lb. with an average daily glucose of 250 mg/dL (HbA1C at 10%). During that year, his triglycerides reached 1161 (high risk for CVD and stroke) and his albumin-creatinine ratio (ACR) at 116 (high risk for chronic kidney disease). He also suffered from five cardiac episodes within a decade. In 2010, three independent physicians warned him regarding the need for kidney dialysis treatment and the future high risk of dying from his severe diabetic complications.

In 2010, he decided to self-study endocrinology with an emphasis on diabetes and food nutrition. He spent the entire year of 2014 to develop a metabolism index (MI) mathematical model. During 2015 and 2016, he developed four mathematical prediction models related to diabetes conditions: weight, PPG, fasting plasma glucose (FPG), and HbA1C (A1C). Through using his developed mathematical metabolism index (MI) model and the other four glucose prediction tools, by the end of 2016, his weight was reduced from 220 lbs. (100 kg) to 176 lbs. (89 kg), waistline from 44 inches (112 cm) to 33 inches (84 cm), average finger-piercing glucose from 250 mg/dL to 120 mg/dL, and A1C from 10% to ~6.5%. One of his major accomplishments is that he no longer takes any diabetes-related medications since 12/8/2015.

In 2017, he achieved excellent results on all fronts, especially his glucose control. However, during the pre-COVID period, including both 2018 and 2019, he traveled to ~50 international cities to attend 65+ medical conferences and made ~120 oral presentations. This hectic schedule inflicted damage to his diabetes control caused by stress, dining out frequently, post-meal exercise disruption, and jet lag, along with the overall negative metabolic impact from the irregular life patterns; therefore, his

glucose control was somewhat affected during the two-year traveling period of 2018-2019.

He started his COVID-19 self-quarantined life on 1/19/2020. By 10/16/2022, his weight was further reduced to ~164 lbs. (BMI 24.22) and his A1C was at 6.0% without any medication intervention or insulin injection. In fact, with the special COVID-19 quarantine lifestyle since early 2020, not only has he written and published ~500 new research articles in various medical and engineering journals, but he has also achieved his best health conditions for the past 27 years. These achievements have resulted from his non-traveling, low-stress, and regular daily life routines. Of course, his in-depth knowledge of chronic diseases, sufficient practical lifestyle management experiences, and his own developed high-tech tools have also contributed to his excellent health improvements.

On 5/5/2018, he applied a continuous glucose monitoring (CGM) sensor device on his upper arm and checks his glucose measurements every 5 minutes for a total of 288 times each day. Furthermore, he extracted the 5-minute intervals from every 15-minute interval for a total of 96 glucose data each day stored in his computer software.

Through the author's medical research work over 40,000 hours and read over 4,000 published medical papers online in the past 13 years, he discovered and became convinced that good life habits of not smoking, moderate or no alcohol intake, avoiding illicit drugs; along with eating the right food with well-balanced nutrition, persistent exercise, having a sufficient and good quality of sleep, reducing all kinds of unnecessary stress, maintaining a regular daily life routine contribute to the risk reduction of having many diseases, including CVD, stroke, kidney problems, micro blood vessels issues, peripheral nervous system problems, and even cancers and dementia. In addition, a long-term healthy lifestyle can even "repair" some damaged internal organs, with different required time-length depending on the particular organ's cell lifespan. For example, he has "self-repaired" about 35% of his damaged pancreatic beta cells during the past 10 years.

2.3 Energy theory

The human body and organs have around 37 trillion live cells which are composed of different organic cells that require energy infusion from glucose carried by red blood cells; and energy consumption from labor-work or exercise. When the residual energy (resulting from the plastic glucose scenario) is stored inside our bodies, it will cause different degrees of damage or influence to many of our internal organs.

According to physics, energies associated with the glucose waves are proportional to the square of the glucose amplitude. The residual energies from elevated glucoses are circulating inside the body via blood vessels which then impact all of the internal organs to cause different degrees of damage or influence, e.g. diabetic complications. Elevated glucose (hyperglycemia) causes damage to the structural integrity of blood vessels. When it combines with both hypertension (rupture of arteries) and hyperlipidemia (blockage of arteries), CVD or Stroke happens. Similarly, many other deadly diseases could result from these excessive energies which would finally shorten our lifespan. For an example, the combination of hyperglycemia and hypertension would cause micro-blood vessel's leakage in kidney systems which is one of the major cause of CKD.

The author then applied Fast Fourier Transform (FFT) operations to convert the input wave from a time domain into a frequency domain. The y-axis amplitude values in the frequency domain indicate the proportional energy levels associated with each different frequency component of input occurrence. Both output symptom value (i.e. strain amplitude in the time domain) and output symptom fluctuation rate (i.e. the strain rate and strain frequency) are influencing the energy level (i.e. the Y-amplitude in the frequency domain).

Currently, many people live a sedentary lifestyle and lack sufficient exercise to burn off the energy influx which causes them to become overweight or obese. Being overweight and having obesity leads to a variety of chronic diseases, particularly diabetes. In addition, many types of processed food add unnecessary ingredients and harmful chemicals that are toxic to the

bodies, which lead to the development of many other deadly diseases, such as cancers. For example, ~85% of worldwide diabetes patients are overweight, and ~75% of patients with cardiac illnesses or surgeries have diabetes conditions.

In engineering analysis, when the load is applied to the structure, it bends or twists, i.e. deform; however, when the load is removed, it will either be restored to its original shape (i.e, elastic case) or remain in a deformed shape (i.e. plastic case). In a biomedical system, the glucose level will increase after eating carbohydrates or sugar from food; therefore, the carbohydrates and sugar function as the energy supply. After having labor work or exercise, the glucose level will decrease. As a result, the exercise burns off the energy, which is similar to load removal in the engineering case. In the biomedical case, both processes of energy influx and energy dissipation take some time which is not as simple and quick as the structural load removal in the engineering case. Therefore, the age difference and 3 input behaviors are "dynamic" in nature, i.e. time-dependent. This time-dependent nature leads to a "viscoelastic or viscoplastic" situation. For the author's case, it is "viscoplastic" since most of his biomarkers are continuously improved during the past 13-year time window.

2.4 Time-dependent output strain and stress of (viscous input*output rate)

Hooke's law of linear elasticity is expressed as:

Strain (ε: epsilon)
= Stress (σ: sigma) / Young's modulus (E)

For biomedical glucose application, his developed linear elastic glucose theory (LEGT) is expressed as:

PPG (strain)
= carbs/sugar (stress) * GH.p-Modulus (a positive number) + post-meal walking k-steps * GH.w-Modulus (a negative number)

Where GH.p-Modulus is reciprocal of Young's modulus E.

However, in viscoelasticity or viscoplasticity theory, the stress is expressed as:

Stress
= viscosity factor (η: eta) * strain rate (dε/dt)

Where strain is expressed as Greek epsilon or ε.

In this article, in order to construct an "ellipse-like" diagram in a stress-strain space domain (e.g. "hysteresis loop") covering both the positive side and negative side of space, he has modified the definition of strain as follows:

Strain
= (body weight at certain specific time instant)

He also calculates his strain rate using the following formula:

Strain rate
= (body weight at next time instant) - (body weight at present time instant)

The risk probability % of developing into CVD, CKD, Cancer is calculated based on his developed metabolism index model (MI) in 2014. His MI value is calculated using inputs of 4 chronic conditions, i.e. weight, glucose, blood pressure, and lipids; and 6 lifestyle details, i.e. diet, drinking water, exercise, sleep, stress, and daily routines. These 10 metabolism categories further contain ~500 elements with millions of input data collected and processed since 2010. For individual deadly disease risk probability %, his mathematical model contains certain specific weighting factors for simulating certain risk percentages associated with different deadly diseases, such as metabolic disorder-induced CVD, stroke, kidney failure, cancers, dementia; artery damage in heart and brain, micro-vessel damage in kidney, and immunity-related infectious diseases, such as COVID death.

Some of explored deadly diseases and longevity characteristics using the viscoplastic medicine theory (VMT) include stress relaxation, creep, hysteresis loop, and material stiffness, damping effect based on time-dependent stress and strain which are different from his previous research findings using linear elastic glucose theory (LEGT) and nonlinear plastic glucose theory (NPGT).

Note: For a more detailed description, please refer to the "consolidated method" section

which is given at the beginning of the special issue.

3. RESULTS

Figure 1 shows comparison data table between "new with forced initial condition" and "old without forced initial condition".

Paper No.	Output	Key Input	Old Accuracy	New Accuracy	Old R	New R
#938	CVD	Dental Gum	100%	98%	-25%	84%
#937	H. Age	CVD,CKD,Cacer	100%	99%	-39%	-55%
#935	Cancer	BW, T2D, Gene	100%	99%	68%	88%
#934	CKD	BW, T2D, Renal	100%	99%	75%	84%
#933	CVD	BW, T2D, Artery	100%	99%	59%	50%
#931	CVD	BW, FPG, PPG	100%	100%	78%	82%
#930	CKD	BW, FPG, PPG	100%	100%	85%	83%
#929	Cancer	BW, FPG, PPG	100%	100%	85%	85%
#928	Cancer	5 mi values	100%	100%	87%	87%
#926	PPG	Carbs, Ksteps	100%	99%	77%	89%
#925	1st Gum	m1, m2, m34	100%	97%	-47%	3%
#925	2nd Gum	m1, m2, m34	100%	96%	-64%	10%
#924	CVD	m1,m2, gum	100%	98%	90%	77%
#924	CKD	m1,m2, gum	100%	98%	97%	90%
#924	Cancer	m1,m2, gum	100%	100%	96%	88%
#915	M.PPG	LEGT PPG	99.8%	99.6%	92.2%	89%
#915	M.PPG	VMT PPG	100%	99.1%	76%	85%
			Old Accur.	New Accur.	Old R	New R
Total	*17 Cases*	*All of 17*	*100%*	*99%*	*52%*	*66%*
	13 Cases	*13 positive %*			*82%*	*83%*

Figure 1: Comparison data table between "new with forced initial condition" and "old without forced initial condition".

4. CONCLUSION

In summary, this study presents three significant observations:

1. When comparing the VMT analysis results with the "forced initial condition" versus without, the "new with" case exhibited an average prediction accuracy of 99%, whereas the averaged prediction accuracy for the "old without" cases was 100%.

2. Out of the total 17 cases with different waveform correlations, the "new with" case achieved a correlation of 66% compared to 52% for the "old without" cases. However, when considering only the 13 cases with positive correlations, the "new with" case showed a correlation of 83% while the "old without" case had a correlation of 82%.

3. In conclusion, the "new with forced initial condition" cases resulted in a 1% decrease in prediction accuracies compared to the "old without" cases, but they exhibited a 14% higher correlation for all 17 cases or a 1% higher correlation for the 13 cases with positive correlations. Thus, sacrificing 1% of prediction accuracy in order to gain a 14% improvement in waveform correlation is a worthwhile endeavor.

5. REFERENCES

For editing purposes, majority of the references in this paper, which are self-references, have been removed for this article. Only references from other authors' published sources remain. The bibliography of the author's original self-references can be viewed at www.eclairemd.com.

Readers may use this article as long as the work is properly cited, and their use is educational and not for profit, and the author's original work is not altered.

For reading more of the author's published VGT or FD analysis results on medical applications, please locate them through platforms for scientific research publications, such as ResearchGate, Google Scholar, etc.

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Viscoelastic and Viscoplastic Glucose Theory Application in Medicine

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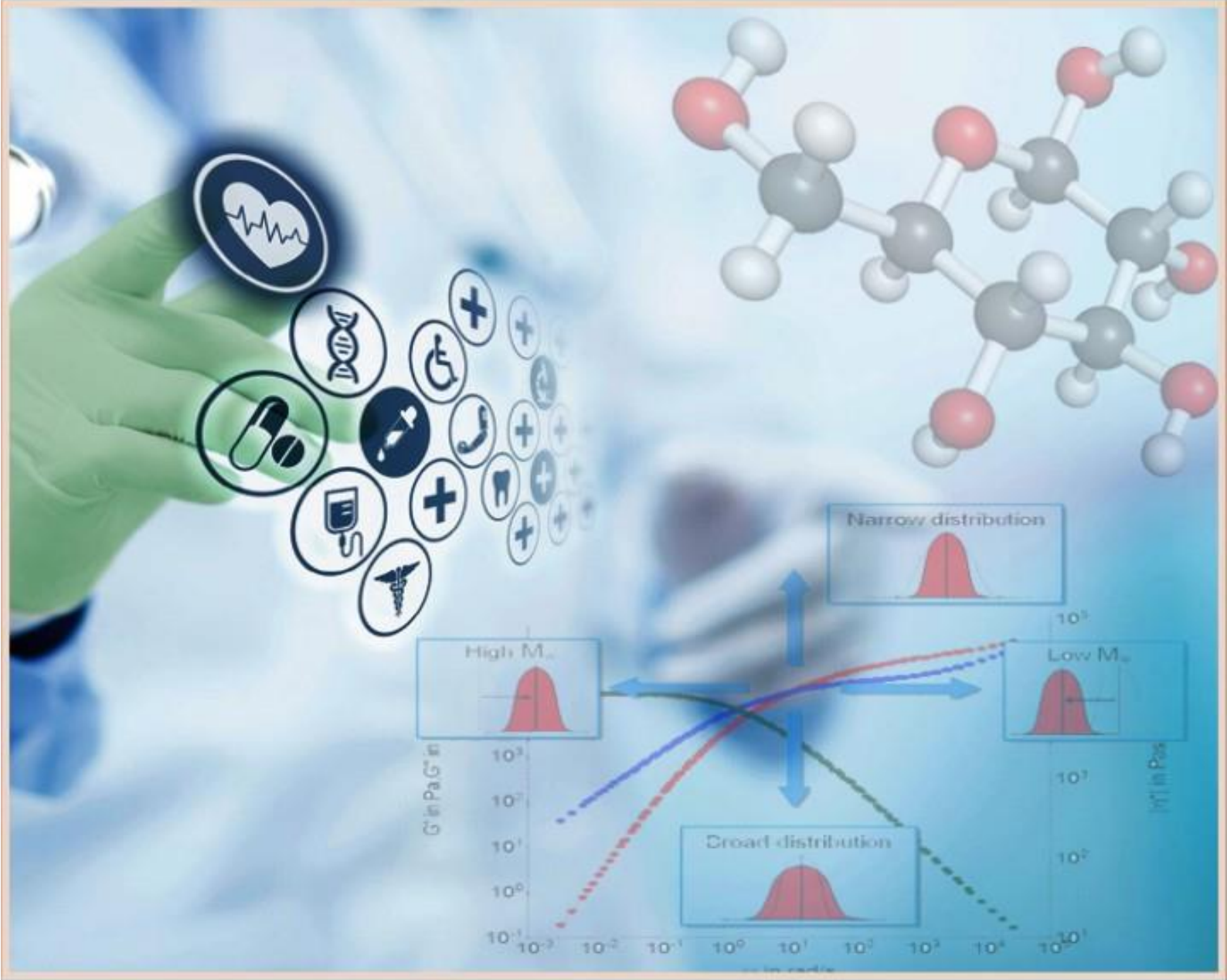

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