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Literature Review

Co-relation between Rotated Mandibles and Back and Knee Pain

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Abstract

This study was carried out to evaluate the co-relation between mandibular rotations in patients with a history of mid back pain, lower back pain and knee pain. Data was obtained from 48 subjects in the form of face photographs, photograph of the position of the feet after the Smylist® three jump test and a detailed Smylist® history form. The face photographs were evaluated and the mandibular rotations were determined and diagnosis carried out based on the Smylist® concept. This was then cross checked with the foot position photographs and the mandibular rotations confirmed. This study confirms that the representative foot positions discrepancy is seen in all mandibular rotation cases as postulated by the Smylist® concept. All 48 cases demonstrated mandibular rotation of varying severities and all of them reported varying degrees of one or more of the three categories of pain. The study definitely demonstrates the co-relation between mandibular rotation and foot position discrepancy which leads on to posture compensations of various forms leading to mid back, low back and knee pain.

Keywords: *Mandible; Rotation; Back Pain; Knee Pain; Smylist; Mandibular; Rotated; Negative; Cascade*

Introduction

The human body is a complex interconnected network which can be observed and understood as an interactive interplay of various components, each playing its unique role in maintaining the functionality of the human body. Human observations have classified these components into various systems with its individual roles to play. A couple of key systems are the musculo skeletal system and the nervous system. The musculo skeletal system has been very aptly described in the Smylist® concept as a spiders web running from the top of the head to the tip of the toes. Working in harmony with signals received from the nervous system, the muscles function by contracting and elongating at the required times to provide locomotion, ability to eat, speak so on and so forth. The complexity of a supposedly simple action of catching a ball thrown at an individual, is enormous. There are thousands of messages send and received and a large number of muscles which contract and relax in a geometric sequence of events to catch the ball.

An understanding of these systems has demonstrated that the musculo skeletal system intrinsically attempts to stay in a state of relaxation and bilateral balance with no muscles being over strained or in a state of spasm. It has also been observed that there has to be complete harmony during action to ensure optimum function. The nervous system works in close conjunction by assessing the state

of the muscles and receiving signals via the sensory part and effecting motion with the motor part of the nervous system. Based on this fundamental working the Smylist® concept has presented a number of clinical cases which have shown the effect of muscular imbalance of the facial muscles and how the body sequentially compensates for it in a variety of different ways depending upon the type and severity of the imbalance. Smylist® has created a new nomenclatures to explain the malposition of the mandible due to an imbalanced muscle pull. Since the mandibular movement should ideally be an equal and balanced rotation of the condyles in the glenoid fossa, when the mandible gets asymmetrically displaced it is termed as a mandibular rotation in the Smylist® concept. This may be to the right or the left or even over-rotated or under rotated.

Smylist® has compared the musculo skeletal system to a spiders web and how a tug at a focal point in the web can lead to pulls and compressions in the entire web. Similarly a mandible that is not in its right position will lead to a muscular imbalance and create a chain of events which could impact muscles right down to the feet and the toes. These clinical observations have shown that these imbalances also can be specifically corrected when the mandible position is corrected. This study is to demonstrate this kind of imbalances in a human population.

Review of Literature

There is reference in the literature about the effect the mandibular position can have on the posture. Even though there is no clear defined line of thought about how this happens, there have been a number of reports indicating a possible connection. Studies suggest that tension in the stomatognathic system can contribute to am impaired neural control of posture. Numerous anatomical connections between the stomatognathic system's proprioceptive inputs and nervous structures are implicated in posture position. If the proprioceptive information of the stomatognathic system is inaccurate, then head control and body position may be affected.

Gangloff and Perrin [1] submitted an hypothesis that periodontal receptors can influence body posture. They found a significant alteration of postural control after unilateral truncular anesthesia of the mandibular nerve. In fact, unilateral anesthesia of the trigeminous causes a shift in body weight onto the contralateral limb, which leads the homolateral inferior limb to contract.

Another observation in the literature is that a symmetric mandibular position results in a more symmetric contraction pattern of the sternocleidomastoid muscle which in turn reduces body sway. Other studies suggested that dental occlusion may influence body posture and spine curvature. One study checked the effect of increasing the VDO on the isometric strength of the cervical flexors and deltoids. The study found that a step wise increase in the VDO increased the strength of these two muscles to a certain point and after the peak, the strength diminished as the VDO was further increased further. Yet one more study found that in patients with TMD the head was invariably more forward positioned.

One study presented that the reconstruction of occlusal support at a desirable mandibular position has tremendous significance and value, not only for the restoration of masticatory function but also for the maintenance of physical exercise in the entire body. Another study concluded that clenching and occlusal instability are directly associated with lateral body weight distribution changes. Yet one more study showed that vision influences body posture, and a weak correlation was observed between mandibular position and body posture in healthy subjects.

The general consensus in the literature states that a definite correlations exists between posture and the Stomatognathic System. However, due to the complexity of the factors and the lack of a logical theory of the progression of events has left many gaps in this connectivity. The Smylist® concept has presented this logical progression of events very lucidly in a previously published article on the Negative Cascade effect. The number of studies in the literature provide extensive evidence in bits and pieces to substantiate the Smylist® explanation. All of this is the basis on which this study has postulated that a rotated mandible leads to problems in the musculo skeletal system giving

rise to back pains and knee aches and at the same time the body compensates with imbalanced postures which can be observed in the way the patient stands in a natural position [2-14].

Aims and Objectives

The aims and objectives of this study were as follows:

- To ascertain the foot position after the three jump test and co-relate it with the facial signs of mandibular rotation.
- To find the incidence of knee pain in subjects with a rotated mandible.
- To find the incidence of mid back pain in subjects with a rotated mandible.
- To find the incidence of lower back pain in subjects with a rotated mandible.

Materials and Methods

A total of 53 subjects were recruited and data collected for all the subjects in the form of a questionnaire and photographs. The questionnaire form is attached as Appendix A with this article. The forms were filled by the two principal investigators and were in English language. The photographic documentation was also carried out by the two principal investigators.

The inclusion criteria was as follows:

- Should be between the age of 30 and 60
- Should not have any history of intraoral trauma
- Should not have advanced active periodontal disease
- Should not be undergoing orthodontic treatment
- Should not have more than 4 missing teeth
- Should not be having Downs syndrome.
- Should not be suffering from any debilitating disease.

The photographs made for all the subjects were as follows:

- Front face
- Left and right profile
- Smyist® Cheese A front face picture
- Foot position after the Smylist® three jump test.

All the photographs were made with a DSLR camera. The front face and the left and right views were as taken conventionally for documentation. The Cheese A photograph is a specific view as defined in Smylist®. This is a front face tight picture taken after the subject

is asked to say the word Cheese followed by the letter A. The letter A has to be said as a long trailing A like "aaaaaaaaaaaaaaaaaa". The picture is to be clicked when the patient is saying "aaaaaaaaaaaa". The purpose is to make the subject stretch the mouth as wide as possible simulating a smile. This allows the capture of muscle positions on the face very clearly. These photographs will be used in the study to assess mandibular rotations.

Figure 1: *Front face picture demonstrating classic signs of a rotated mandible.*

The foot position was photographed after the patients were put through the Smylist® three jump test. The three jump test is an original concept designed in the Smylist® methodology. Smylist® has demonstrated that a rotated mandible will lead to compensations in the musculoskeletal system and the body compensates in a variety of different ways leading to improper and unbalanced postures. A rotation of the mandible leads to the neck, shoulder, back, hip, legs and feet muscles becoming imbalanced and leading to rotations as a cascade of events. The most important key in diagnosis is to identify these compensations. There would be no purpose served in trying to get a patient into an ideal posture for purposes of diagnosis. An ideal posture is the goal or therapy and not diagnosis. The Smylist® three jump test is a very intelligent and smart way of assessing body weight distribution. It gives a tremendous amount of information in a quick and simple way. The learning curve is almost non existent and can be applied instantaneously and the test is carried out in a couple of minutes. All the subjects were asked to do the Smylist® three jump test and then the foot position was photographed.

The history form data was then transcribed to an excel spread sheet. All the subjects photographs were then analysed and the data was added to the basic spreadsheet. This spread sheet data was then statistically analyzed and the results are presented in the tables in this article.

Results

Out of the 53 subjects, 5 were not included because of multiple reasons of issues in the photographs which did not allow a full diagnosis to be made. The age range of the subjects was from 40-79. Even though an equal distribution between males and females was attempted, it was not feasible. There were a total of 23 females and 15 males in the study. All the faces were checked thoroughly for the classic signs of mandibular rotations based on the Smylist® parameters. These were the positioning of the nasolabial fold, the flattening/hypertrophy of the zygomaticus, the status of the mentalis and the masseter muscles, the position and contour of the wrinkles under the eyes and when severe, the obvious distortion on the face. The head tilt was also taken into account. Base on the above findings the results were as follows.

Type of Rotation	Subjects	Percentage
No Rotation	1	2.1%
Right (Mild)	4	8.3%
Right (Moderate)	20	41.66%
Right (Severe)	5	10.41%
Right Total	29	60.41%
Left (Mild)	3	6.25%
Left (Moderate)	11	22.9%
Left (Severe)	4	8.3%
Left Total	18	37.5%

Table 1: *Mandibular rotations observed on the photographs.*

As is evident from the results only around 2% of the subjects were in the "No Rotation" group. All the others had right or left rotated mandibles. There were a few of these who also had an over-rotated mandible in conjunction with the right/left rotation. Accurate diagnosis of over rotation would need an intra oral examination by an experienced Smyist dentist and hence it was included as part of the results. The results also show that half the rotations were in the moderate category which usually leads to one or the other debilitating systemic conditions. It is indeed a very high number to have 98% of the subjects to have a rotated mandible condition. This high incidence of rotated mandible cases will be dealt with in full detail in the discussion section of the article.

The rotated mandibles diagnosis was co-related with the foot positions data captured after the Smylist® three jump test. The test has been described in the Materials and Methods section. The key rationale of this test is to be able to assess the natural postural load patterns of the body. This very simple but absolutely logical method ensures that the proper postural loads are obtained from the subjects.

The foot pattern of all subjects was assessed for different parameters. The most important pattern which was evaluated for this study was the position of the feet in relation to each other. There are other parameters like inward/outward positions, asymmetry, length of feet which have not been evaluated in this study. The possible variations of foot position evaluated are "Right foot behind", "Left foot behind" and "Equally placed". The following three photographs demonstrate these three possible positions.

Figure 2: *The right foot behind pattern.*

Figure 3: *The left foot behind pattern.*

Figure 4: *Symmetrical foot pattern.*

The foot pattern of all the subjects were grouped as follows.

Foot Pattern	Subjects	Percentage
Both symmetrical	4	8.33%
Right foot behind	28	58.33%
Left foot behind	16	33.33%

Table 2: *Foot patterns observed on the photographs.*

Only 8.33% of the subjects showed a symmetrical foot pattern after the three jump test. This test brings the patient to the most natural load pattern and presents the discrepancy very clearly. There were 58.33% subjects who had the right foot behind while 33.33% of the subjects had the left foot behind. Smylist® has given a detailed explanation of how a right rotated mandible leads to a foot pattern with the right foot behind and vice versa. The next table confirms this relationship between the foot pattern and the facial diagnosis of the mandibular rotation.

The foot patterns were co-related with the mandibular rotation and the results are presented in the following table.

Mandibular Rotation	Subjects	Right Foot behind	Left foot behind	Both symmetrical
No Rotation	1	1	0	0
Right rotated	29	27	0	2
Left rotated	18	0	16	2

Table 3: *Co-relation between mandibular rotation and foot pattern.*

The results of this table amply demonstrates the expected foot patterns of subjects with expected rotations signs on the face. Of the 29 subjects who had a right rotated mandible, 27 had the classic foot pattern with right foot behind. Of the 18 who had a left rotated mandible, 16 of them had the left foot behind. Two subjects each in both the groups showed a more or less symmetrical pattern. This could be attributed to the body compensating with muscle imbalances without showing any body rotations. It is very important to note that many of the subjects probably had an upward rotation in conjunction with the right and left rotations. Mild and moderate upward rotation would need a detailed intra oral examination and palpation of the condyles and the mandible which was not possible and was beyond the scope of this study. Severe cases of upward rotation do show up with signs on the face and there were at least 5 to 6 subjects whose photographs indicated a severe upward rotation along with a right/left rotation.

With the information available from the photographs the rotations were also divided into three groups based on the extent of the rotation. Parameters used were asymmetrical discrepancies between the right and the left, tilt of the head, the extent of foot discrepancy and the amount of hypertrophy of the relevant facial muscles and an associated over rotation. The results are as follows.

Intensity of Rotation	Subjects	Percentage
Mild	7	14.89%
Moderate	32	68.08%
Severe	9	19.14%

Table 4: *Severity grade of the mandibular rotation.*

The majority of the cases were in the moderate to severe category which was to be expected from this age group of 40 plus subjects. The initial basis of a mandibular rotation is the incorrect stop provided by the maxillary teeth. This is what positions the mandible incorrectly. With time and wear and tear of the teeth the rotation severity progresses. The results seem to indicate that the mandible settles into the rotated position in most individuals while in some of them it is continually progressing into more severe situations.

The subjects were then assessed for the three symptoms of mid back pain, lower back pain and knee pain. The results are presented in the following table.

Symptom	Subjects	Percentage
Mid Back Pain	22	45.83%
Lower Back Pain	30	62.5%
Knee Pain	29	60.41%

Table 5: *Subjects with mid back, lower back and knee pain.*

It is evident from this table that there are a number of subjects with more than one of these three symptoms. Further details revealed that there were only 10 subjects who did not present any of these three symptoms which is about 20.83% of the subjects. Since there was only one subject who did not show a mandibular rotation, it is deduced that 20% of the subjects did not have any of these three problems despite having a rotated mandible. This could be due to a higher threshold of pain. It has to be kept in mind that mandibular rotations also lead to quite a few other symptoms have not been included in this study. It is a supposition that almost all individuals with a rotated mandible will invariably develop a systemic problem due to the bodies compensatory mechanism as a result of the imbalance created. It is also a given that all the subjects with symptoms definitely had a rotated mandible. The next table presents the subjects exhibiting multiple symptoms.

No. of Symptoms	Subjects	Percentage
No symptoms	10	20.83%
Only one symptom	12	31.57%
Any two symptoms	9	23.68%
All three symptoms	17	35.41%
Subjects with at least one symptom	38	79.1%

Table 6: *Varying number of symptoms.*

A significantly large number of subjects, 35.41% had all the three symptoms. This just establishes the importance of correcting rotated mandibles. Even with this limited data collection study it showed that nearly 80% of the subjects had one of these three symptoms.

These symptoms were then co-related with the mandibular rotation. The group with knee pain was first analyzed. The following table is the result of the knee group.

Location of Pain	Subjects	Percentage	Rotated mandible
Right Knee	3	10.34%	All
Left Knee	4	13.79%	All
Both Knees	22	75.86%	All

Table 7: *Pattern of knee pain.*

Of the total of 29 subjects with knee pain 75.86% of them reported with pain in both the knees. The balance had pain in either one of the two knees. All these subjects presented with a mandibular rotation. One additional parameter that could have been assessed would have been for the group which reported pain in both knees, could have been the intensity of pain in the two knees and if one knee hurt more than the other. As can be seen in the table, all the subjects with any form of knee pain had rotated mandibles. The nature of the knee pains was then assessed. In addition, the severity of rotation was also checked for each of the three groups. The results are in the following table.

Grade	Subjects	Percentage	Mild Rotation		Moderate Rot		Severe Rotation	
			Subjects	%	Subjects	%	Subjects	%
Mild	12	41.37%	2	16.6%	6	50%	4	33.3%
Moderate	5	17.24%	0	%	3	60%	2	40%
Severe	12	41.37%	3	25%	8	66.6%	1	8.3%

Table 8: *Pattern of severity of knee pain.*

In this table the results seem to indicate that the severity of knee pain does not seem to be increasing with more severe rotations. The pattern of rotated mandibles is similar for all three groups exhibiting knee pain. In fact, in the most severe group of knee pain the percentage of severe rotations was the least.

Another analysis was carried out for subjects with only one symptom, two symptoms and three symptoms and the severity of mandibular rotation checked. The results are in the following table.

Symptoms	Subjects	Percentage	Mild Rotation		Moderate Rot		Severe Rotation	
			Subjects	%	Subjects	%	Subjects	%
One	12	26.31%	1	8.33%	9	75%	2	16.66%
Two	9	28.94%	2	22.22%	5	55.55%	2	22.22%
Three	17	44.73%	4	23.5%	9	52.94%	4	23.5%

Table 9: *Mandibular rotation grades in groups based on 1, 2, 3 symptoms.*

The results of this table are also interesting and show that individuals can get multiple symptoms even with a mild rotation and individuals with severe rotations do not necessarily have more than one symptom. But this table does show that half of the severe rotations have three symptoms. It also shows that nearly half of the mild rotations also have 3 symptoms.

Discussion

There have been a number of studies published which have attempted to co-relate occlusion and the stomatognathic system with the functioning with the rest of the body. Almost all studies have started with occlusal relationships and conventional malocclusion classifications and studied the influence it could possibly have on posture, the musculo skeletal system and a few other conditions. This study was designed around the basic premise of mandibular rotations as laid down in the Smylist® concept. A mandibular rotation is an improper position of the mandible, in the sense that the muscles of the mandible and the face do not stay in symmetry and harmony. The diagnosis of "mandibular rotations", which is the new nomenclature created by Smylist® to clearly identify improper and asymmetrical mandibular positions, was obtained from the face photographs of the subjects recruited in this study. One of the primary objectives was to confirm the

body balance and natural foot posture in subjects with mandibular rotations. It was very important to obtain the natural foot positions. The authors could not locate a single study observing foot postures which would be the natural position of the individual. This is the reason Smylist® has the three jump test which allows obtaining the natural given position. It is quite a surprise that most foot based data is obtained from a forced position for testing, which makes such studies completely pointless. The Smylist® three jump test is extremely easy to learn and perform. As was expected a huge majority of the 47 subjects who had mandibular rotations also exhibited a discrepancy in the right and left foot positions. Only four of the 43 subjects had a symmetrical foot position after the three jump test. This data definitely indicates that the foot position discrepancy should be used as a confirmed diagnostic indicator for mandibular rotation.

This study also checked for three basic symptoms which are often related to occlusion. The Smylist® concept is different and it rather checks for a mandibular rotation and relates it to the three pain symptoms. The mandibular rotation is based on asymmetrical and imbalanced muscle function and the occlusion is only the end resultant of the process. This study is a very preliminary study where in disturbed muscle activity of the mandible, leading to its rotation is being co-related with mid and lower back ache and knee pain. This study cannot be compared to any other study which is checking occlusion and its co-relation to other pain symptoms. The results obtained have been very interesting with 38 of the 48 subjects complaining of one of the symptoms or more than one of the symptoms co-existing. All the 38 patients who complained with one of the three symptoms, were having a mandibular rotation. Of course at this preliminary level, it can only be concluded that a very strong co-relation exists between these systemic disorders and mandibular rotation. A more extensive study would be needed in which the subjects would have to undergo a stringent medical examination and associated investigations to rule out other medical reasons for the symptoms, so as to be able to make the mandibular rotation as the cause of the back and knee pain.

On the other hand there were 10 subjects in this study who definitely had mandibular rotations but did not exhibit any of the three symptoms. The explanation for this is that mandibular rotations can lead to a variety of symptoms even other than the three documented in this study. This is dependent on each individuals body compensation. The other factor to be kept in mind is that the mandibular rotation may not initially lead to a systemic problem. A detailed dental examination could reveal initial dental damage due to the mandibular rotation.

The study also checked for severity of the symptoms as well as the presence of more than one symptom in all subjects. These groups were than co-related with the extent of rotation which was also divided into mild, moderate and severe. It has to be noted that this grouping into mild, moderate and severe was based only on photographic diagnostic indicators and for a very precise diagnosis it would be necessary to do a physical extra oral and intraoral examination. The findings were interesting that the severity of rotation did not necessary lead to severe symptoms or all three symptoms. In fact, most of the subjects were clustered under the moderate category of rotations. This could indicate that over time mandibular rotations stay in the moderate category and the symptoms only slowly increase over time.

The overall results have amply indicated that mandibular rotation is an extremely common phenomenon and is associated with a large number of systemic problems. The results also show a trend that the mandibular rotation in a large majority of individuals will manifest as some systemic symptom which can be traced back to the mandibular rotation as a sequence of events. This study which was carried out without any physical examination of the subjects but still revealed excellent pertinent information, definitely warrants more detailed studies to connect all the dots and provide complete evidence of how these events progress.

Conclusion

It can be concluded from this study that in all individuals who exhibit facial signs of mandibular rotation will always have the body balance altered which can be confirmed with the unique Smylist® three jump test. Even if all rotations do not show foot asymmetry, the converse is always true. Any foot asymmetry is a direct indicator of a mandibular rotation. It can also be concluded that the vast majority of individuals who have mandibular rotation will manifest symptoms of knee joint pain, mid back pain and lower back pain. The severity

and multiple symptoms in any individual do not seem to be necessarily directly related with the severity of the mandibular rotation. It can be finally said that the era has come where physicians, orthopaedics and physio therapists should work in close conjunction with Smylist® dentists to ensure the actual reason and correction of the source of the problem for their patients.

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