

The Vertical Dimension of Speech: The Pilot of Occlusion



by Earl Pound, DDS

INTRODUCTION

This article discusses the various problems of vertical dimension, namely those of the face, of occlusion and of speech. It stresses why the vertical dimension of speech should be used as the primary guide for establishing the vertical dimension of occlusion and when performing restorative procedures. The control for the vertical dimension of speech is the repetitive position the mandible assumes when a person is enunciating “s” sounds at conversational speed.

THE FACE

The vertical dimension of the face is related primarily to esthetics. It is defined as a “vertical measurement of the face between any two arbitrarily selected points located one above and one below the mouth, usually in the midline.”¹

This measurement is useful for comparing various vertical dimensions of occlusion and relating them to the vertical dimension of the rest position. Its importance is of secondary value, however, because the vertical dimension of occlusion cannot be established from this measurement alone.

VERTICAL DIMENSION OF OCCLUSION

The vertical dimension of occlusion is probably one of the most researched phases of complete denture prosthodontics, and the search for more valid controls continues. It is defined as a “vertical dimension measurement of the face when the teeth or occlusion rims are in contact

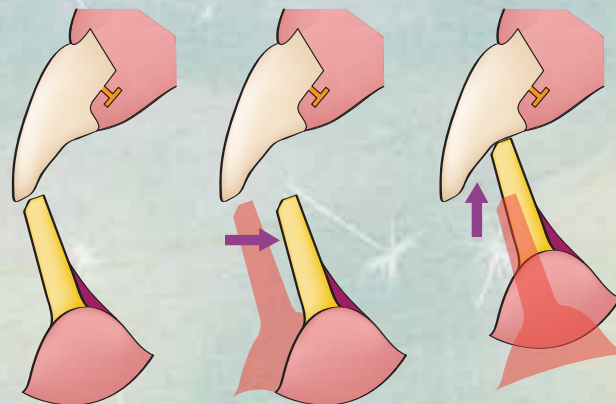


Figure 1: Procedure used to develop the vertical dimension of occlusion by simple retrusion to a comfortable hinge position and closure to contact, illustrating a classic “s” position with a Class I occlusion.

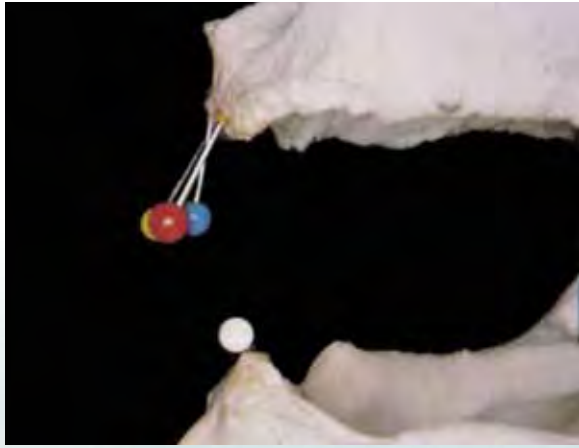


Figure 2: The ball on the lower ridge represents the repeatable mandibular level of the “s” position and the vertical dimension of speech. The three balls indicate the area in which different dentists might place incisal edges of upper centrals. If lower centrals are set to corresponding “s” positions, the effects on esthetics and the vertical dimension of occlusion are very minor.



Figure 3: A classic “s” position of a Class II patient. Note the visibility and the wide posterior speaking space created by gross horizontal and vertical overlaps.

in centric relation.” Many techniques are available for obtaining this level of occlusal contact, and the results vary considerably. J. Landa has stated that “the determination of the maxillo-mandibular opening is, to a great extent, work of an imaginative nature.”²

The vertical dimension of speech should be used as the primary guide for establishing the vertical dimension of occlusion.

Such wide variations of these former results are completely unnecessary if the vertical dimension of speech is incorporated into the development of the occlusal scheme, as it always indicates the most open and most closed usable vertical dimension of occlusion, regardless of the degree of ridge resorption or age. A recent article discussed that the vertical dimension of occlusion can be developed by setting the upper and lower anterior control teeth to the “s” positions and then retruding and closing the mandible until the lower anterior teeth are in contact (Fig. 1). These same anterior controls, which are the key to the vertical

dimension of speech, have a specific protective bearing on the vertical dimension of occlusion and in determining the interocclusal posterior space required for different classes of occlusion.

VERTICAL DIMENSION OF SPEECH

Although the “s” position can be considered either mandibular or dental, it is the mandibular position that is the key to the vertical dimension of speech (Fig. 2). When “s” sounds are being enunciated at conversational speed, the mandible moves to the most forward and upward (closed) position it ever assumes during speech. This spatial position is repetitive and recordable to within 1 mm of accuracy. The operational platform the dentist uses is the anterior ridge of the mandible. Through this he relates the teeth he places upon it to the static position of the upper central incisors, making this mandibular “s” position visible and usable in establishing both the vertical dimension of speech and the clarity of the “s” sounds (Fig. 2, 3). These replacements should theoretically restore the size and angle of the lost teeth and the approximate amount of lost bone structure.

All languages studied have visible and audible “s” positions.



Figure 4: This classic "s" anterior speaking space can occur labial, edge-to-edge or slightly lingual to the upper incisors.

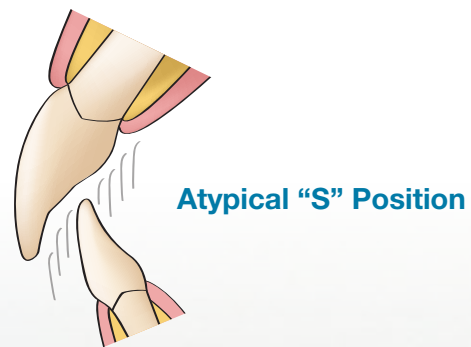


Figure 5: In atypical "s" positions, sharp enunciation is possible as far lingual as the gingival tissues.

MECHANICS OF THE "S" POSITION

It is the muscles that control the mandibular movements of speech that can move the mandible and its teeth into the "s" position. When this occurs, if natural teeth exist, the lower incisors are carried to within 1 to 1.5 mm of the incisal edges or lingual surfaces of the upper central incisors. The resulting "s" sound is actually a subtle whistle created when air is forced between these two hard surfaces. It is this clearance (or space between these teeth) and the subtle whistle that permit the operator to clearly identify the "s" level of the mandibular bone. If the tongue intervenes, as it does with tongue thrusters and in some difficult Class II situations, the "s" position cannot be identified as easily. However, the mandibular bone still has a specific "s" level, and this can be ascertained and used for developing the vertical dimension of speech for these types of patients.

The "s" position is constant because the muscles controlling this level are programmed to this activity during a person's formative years. The muscular activity of natural speech is effortless and nontraumatic. Thus, even if a tooth is extracted, the comfortable muscles continue to operate to this same level; in other words, the "s" position of the mandible is the same whether the patient is dentulous or edentulous.

If age or lack of tonicity affects the muscles, all principles still apply, but the vertical dimension of speech and, therefore, of occlusion, may be less than what previously existed, and this is what must be used.

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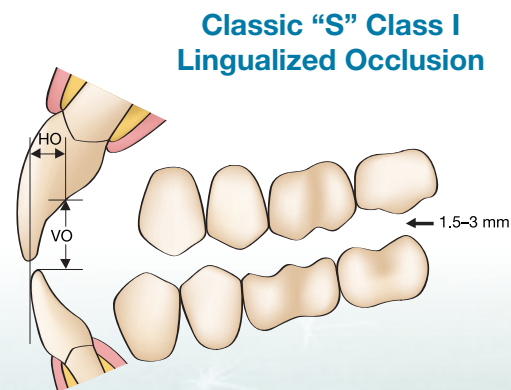
There are two types of sharp "s" sounds. The classic type, and by far the most common, occurs when the "s" clearance exists around the incisal edges of the upper and lower central incisors (*Fig. 4*). The atypical type occurs when the "s" clearance exists at any point on the lingual surfaces of an upper central incisor (*Fig. 5*). Both types permit a clear "s" sound; they always identify the vertical dimension of speech.

The third type of "s" sound is considered abnormal and occurs when the tongue intervenes between the lower anterior teeth when "s" sounds are made. Such abnormal "s" sounds occur with tongue thrusters, and they pose a problem as to how to determine where to position the



**Anterior Occlusions
Verti-Centric
Classes I, II and III**

Figure 6: Normal incisal positions for the three basic classes of occlusion



**Classic "S" Class I
Lingualized Occlusion**

**Posterior "S" Space
2-3 mm Forward Movement
Slightly Variable Verti-Centrics**

Figure 7: This shows the posterior speaking space in a Class I occlusion and how it is influenced by varying horizontal and vertical overlaps. The lesser the forward "s" movement, the smaller the space.

lower anterior teeth and how to identify their vertical dimension of speech and, therefore, their vertical dimension of occlusion.

RELATING SPEECH TO OCCLUSION

There are three basic classes of anterior occlusion: Class I, for which the incisal edges of the lower anteriors rest in or anterior to the cingulum area of the upper central incisors; Class II, in which the lower anterior teeth contact distal to the cingulum and sometimes on the palatal tissues; and Class III, or the edge-to-edge type, which make their contact directly labial to or on the incisal edges of the upper teeth (*Fig. 6*).

All three types must open to disclude the posterior teeth in order to allow a person to speak, and when "s" sounds must be made, 1 to 1.5 mm of clearance must be developed between the upper and lower central incisors.

The amount of discussion depends on the degree of forward movement of the teeth from centric relation to their "s" position. These movements define the incisal guide angle and represent the vertical and horizontal overlaps of the teeth. Thus, the greater the forward movement, the greater the amount of posterior disclusion and the resultant "s" space — or posterior speaking space.

VERTICAL DIMENSION OF OCCLUSION

The teeth should never contact during speech. In fact, the closest contact that ever occurs is when "s" sounds are enunciated, and this "s" clearance should be established when a patient is reading at conversational speed and is unaware of the dentist's interest in the "s" sounds.

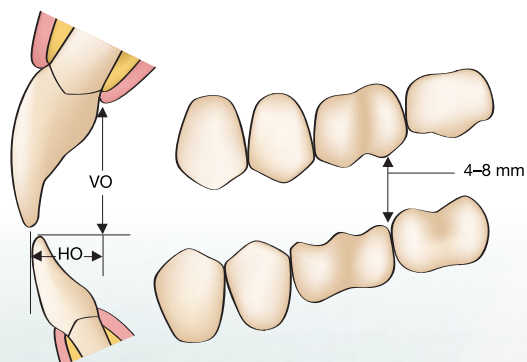
Since the posterior teeth must never contact during speech, the greatest vertical dimension of occlusion for any person must be 1 mm less than the vertical dimension of speech. Otherwise, speech contacts will occur.

Therefore, the vertical dimension of speech should be located first and can be used as a protective guide to determine what the vertical dimension of occlusion should be.

POSTERIOR SPEAKING SPACE

The posterior speaking space — which exists between posterior teeth when "s" sounds are being used — can be used to great advantage in determining the appropriate vertical dimension of occlusion. The size of this space is largely controlled by the distance the mandible moves forward from centric relation to its "s" position. By ascertaining the amount of this movement, the class of occlusion a patient originally had can also be determined.

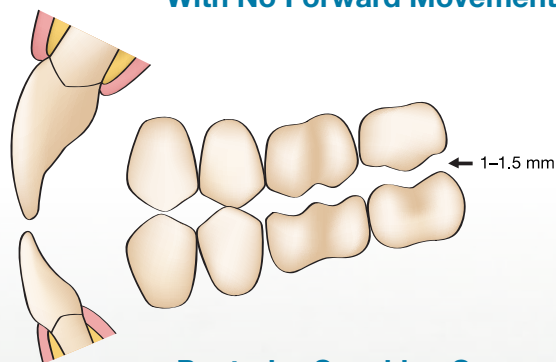
Classic “S” Class II



**Posterior “S” Space
4–10 mm Forward Movement
Variable Verti-Centrics**

Figure 8: Class II patients have greater horizontal and vertical overlaps and, therefore, a larger posterior speaking space, which also varies as shown.

“S” Positions — Class I, II and III With No Forward Movement



**Posterior Speaking Space
Lingualized Occlusion
Minimum-Maximum Verti-Centric**

Figure 9: A Class III occlusion showing minimal posterior speaking space. These occlusions, and very rarely some for Class I and Class II patients, have no forward movement and this same minimal space.

If classic “s” positions exist in Class I occlusions, the forward movement can create a vertical overlap of 1.5 to 5 mm with a corresponding posterior speaking space of 1.5 to 3 mm (Fig. 7). This vertical overlap in Class II patients can vary from 1.5 to 10 mm, and the posterior speaking space can vary from 2 to 8 mm (Fig. 8).

Class III edge-to-edge occlusions have no forward movement, no incisal guide angle and practically no vertical overlap; the posterior speaking space is only a fraction less than the anterior “s” clearance, which is never more than 1.5 mm (Fig. 9).

The time to confirm established tooth positions, speech patterns or jaw relations is at the try-in stage.

Occasionally, a Class I or Class II patient has no or very little forward movement in speech, which can prove very disturbing if not recognized. Such variations never have a classic “s” position, as they are atypical or palatal. Since

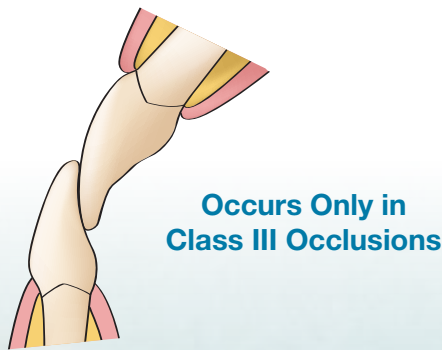
there is no forward movement, their posterior speaking space and their vertical dimension of occlusion should be studied and managed in the same manner as that of Class III patients (Fig. 9); they exhibit the same minimal posterior speaking space.

Another unusual situation occurs with the Class III occlusion, in which the lower anterior teeth are labial to the upper anterior teeth and have a severe labial overlap (Fig. 10). As with all Class III occlusions, these, too, exhibit the classic “s” position; however, the “s” space is labial to the incisal edge of the upper centrals instead of lingual as in Class I and II occlusions.

Patients exhibiting this type of Class III occlusion will also have a gross posterior speaking space. Thus, it is at times advantageous to open the former vertical dimension of occlusion; this will improve appearance during mastication and swallowing and, because masticating and speaking activities are always in centric relation, no temporomandibular joint problems will develop.

Extensive experimentation with diagnostic dentures as problem solvers has indicated that the vertical dimension of occlusion is a more flexible entity than has been assumed, especially in severe Class II and labial version Class III occlusions.

Atypical Anterior Occlusion



Occurs Only in Class III Occlusions

Figure 10: A Class III occlusion with a labial overlap. A classic “s” position always exists in these patients with gross corresponding posterior speaking space.

Lingualized Occlusion

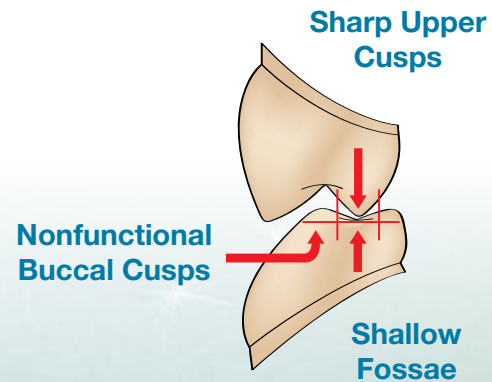


Figure 11: In lingualized occlusion, the efficiency of the lower buccal cusps is eliminated and all sharp upper lingual cusps operate in open lower fossae. This reduces lateral stresses and centralizes the power of chewing for complete dentures.

OPERATIVE PROCEDURES

It is the dentist’s responsibility to ensure that clarity of speech remains after all restorative procedures and that no teeth contact during speech. The space for the subtle whistle of the “s” is the key to success.

When using, as most do, occlusion rims to establish the vertical dimension of occlusion, one has little opportunity to work with speech. The lower anterior teeth, for example, must be positioned primarily by judgment; however, the dentist can change this position at the try-in stage to improve phonetics and then relate the new “s” clearance to the vertical dimension of occlusion that has been established and correct it if necessary. But this may become a very time-consuming procedure.

In contrast, operators who first set the upper and lower anterior control teeth to “s” positions and then obtain the verti-centric registration by retrusion to centric relation and closure to contact³ (Fig. 1) have automatically related the anterior setting to the vertical dimension of occlusion and can usually limit their try-in time to mainly esthetic considerations. To aid in this procedure method, an Analytical Control Chart (page 13) was developed to help control these earlier procedures in relation to the “s” position and occlusion.⁴

Establishing the vertical dimension of occlusion for patients

with normal speech patterns and jaw relations poses no great problem, but serious difficulties can be encountered with some Class II and Class III patients, as well as tongue thrusters and lispers. For these patients, a very visible guide for developing a safe vertical dimension of occlusion is available that uses the vertical dimension of speech.

LET “S” BE YOUR GUIDE

The time to confirm established tooth positions, speech patterns or jaw relations is at the try-in stage. The Analytical Control Chart, sections CD, C15, C16 and C18, can be used to this end by any operator, regardless of how teeth were positioned, who positioned them and what the tentative jaw relations are. The chart recommends that, using an articulator, all teeth except the lower posteriors be set up; a flat wax rim contoured to the width and position of the future lower teeth is to be used in place of the lower posteriors. Here, a lingualized occlusion is strongly advocated because, in addition to other advantages, this will permit only the tips of the lingual cusps to touch the wax rim. Any contacts or the amount of the posterior speaking space will be, thus, clearly visible when the patient is reading at conversational speed (Fig. 11).

If contacts exist, or if there is an insufficient posterior speaking space, the wax can be reduced as necessary. If

When “s” sounds are being enunciated at conversational speed, the mandible moves to the most forward and upward (closed) position it ever assumes during speech.

the space is larger than needed, the vertical dimension of occlusion can be opened by adding layers of wax on the lower rim. In this manner an acceptable vertical dimension of occlusion can be safely coordinated with a satisfactory posterior speaking space (Fig. 7-9). The lower posterior teeth can then be placed and balanced using the condylar controls already established and the refined incisal guide angle.

RESTORATIVE PROCEDURES

These concepts also apply in restorative procedures. In full-mouth rehabilitation, where the operator is required to rebuild the entire occlusal scheme on the articulator, condylar and incisal guide angles are usually established via pantographic writings made by excursions on rather flat surfaces. Such techniques will not, however, record as true an incisal guide angle as the patient had.

During these procedures (before wax-ups and tooth positions or lingual contours are completed), more natural relations between the upper and lower incisors — as dictated by the mandibular movements of speech and a

controlled “s” position — should be developed. This will produce a more accurate incisal guide angle, and the balancing walls of the lower fossae will be in harmony with these more natural controls. A comfortable and esthetic occlusal scheme will then result.

When anterior restorations of any type are being made, “s” controls should be monitored and prematurities of speech cleared. In ceramo-metal procedures or any type of anterior restoration, the framework should be cleared and the biscuit bake should be refined to accommodate the entire range of the mandibular movements of speech.

SUMMARY

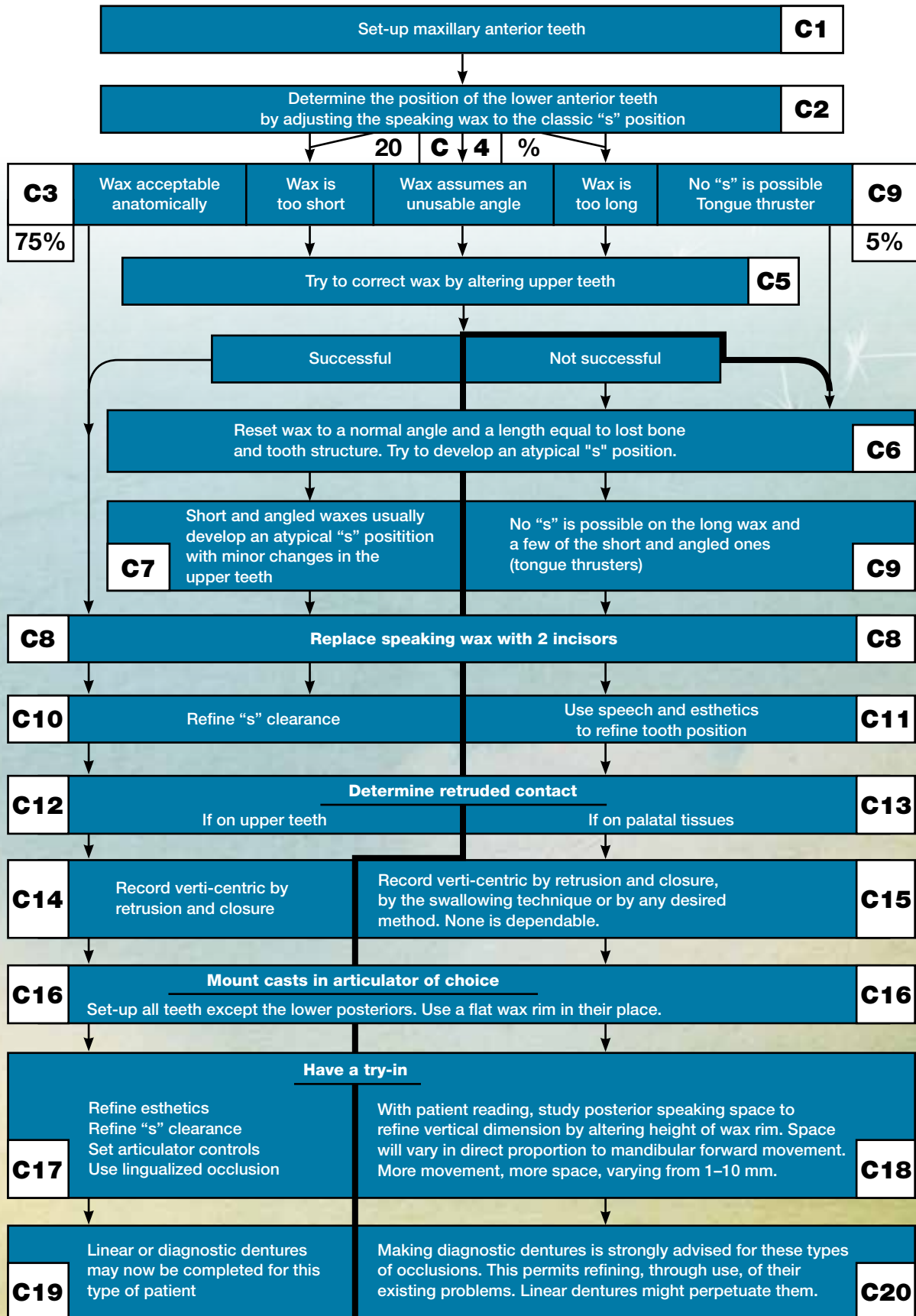
This article has emphasized the value of applying the vertical dimension of speech as a protective and esthetic guide for all forms of prosthetic restorations. It has also reviewed how to use posterior speaking spaces as a control when developing the vertical dimension of occlusion for all types of patients.

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ANALYTICAL CONTROL CHART



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