Letters

Recording condylar movement

I wish to respond to Hicks and Wood in their article, "Recording condylar movement with two facebow systems," in the Angle Orthodontist (1996;66:293-300). This article contains some serious flaws and incorrect statements.

To begin with, the title is wrong. One cannot record condylar movement with an earpiece-type facebow because the facebow is attached to the upper member of the articulator. If one uses an earpiece-type facebow and the same centric record to mount the same models in different arcon-type articulators (as Hicks and Wood did), one should not expect to see different measurements with MPI/CPI because the same parameters are used. Of all the factors that influence MPI/CPI measurement values, the centric record and the mounting procedure are by far the most critical. Hinge axis position, intercondylar distance, and other factors are only theoretical in nature and have no visible effect on MPI/CPI measurements.

The authors found a 0.1-0.2 mm difference between the SAM facebow/SAM articulator combination and the SAM facebow/Panadent articulator combination and concluded that the SAM facebow should not be used with the Panadent articulator. If the authors would take five sets of impressions, five facebows, and five centric records of the same subject and mount them five times to the corresponding articulator, they would be surprised to find a much greater difference than 0.2 mm in the MPI/CPI values. This is regardless of how meticulous one's work is. That means that the reproducibility of the whole procedure is worse than 0.2 mm and that the authors' conclusions are not valid.

None of these systems measure the absolute amount of what the condyles are doing in the patient's joints. In fact CPI/MPI and similar instruments are good only for indicating a trend in the direction of condylar movement, not for absolute, precise numbers.

On page 297 the authors state, "The Panadent system has two key advantages over the SAM: In the Panadent system, the relationship of the upper member to the lower does not change with normal use, and the Panadent better simulates mandibular movement." This statement is not fact but opinion of the authors and has no connection with the study. Therefore, one can only speculate that Hicks and Wood are attempting to use this journal to market the Panadent system, because they apparently prefer to use it.

There is still no published research in the dental literature to support the first claim. In fact, with modern knowledge about materials and sophisticated production processes, there is no reason to believe that any articulator will change with normal use.

Figure 1 shows the recordings of the condylar housing that are normally used in the orthodontic office with both systems. The axis recording of the Panadent Blue Block with 0.5 mm side

Figure 1
Recordings of condylar housing normally used in the orthodontic office with both systems.

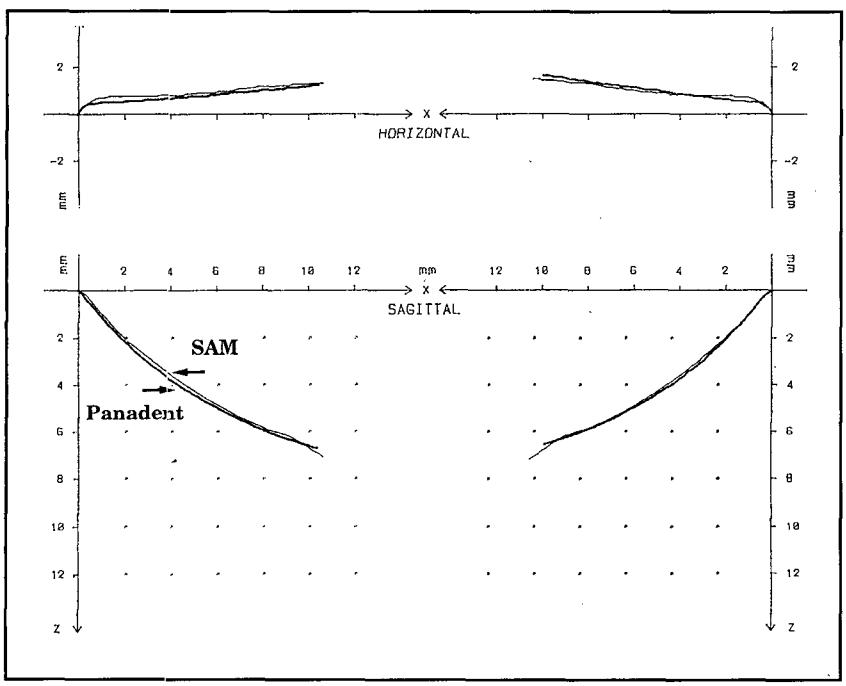

Figure 1

shift shows no significant difference of the condylar pathways as compared with the SAM #2 condylar housing and the green Bennett insert set at 0°. How can the Panadent articulator better simulate mandibular movement when in fact it has the same condylar pathways as the SAM? Interestingly enough, the curvature in all Panadent Blue Blocks is the same; only the immediate side shift differs from 1.0 mm to 2.5 mm. There will be a big difference to the SAM if one uses the Panadent Blue Blocks with more than 0.5 mm Bennett movement. One should not use these because a healthy orthodontic patient does not have immediate side shift, which is a sign of TMJ problems. The orthodontist should use only the 0.5 mm Blue Block.

On pages 297 and 298 the authors speculate about the two reasons for "the differences in recording condylar discrepancies...of the two systems." First they write, "it appears the hole in the ear rod piece is more distal on the SAM facebow than on the Panadent." A few sentences later they write, "The hole in the ear insert is located more forward on the SAM facebow than on the Panadent." One wonders what they really did observe.

On page 298, the second explanation by the authors for the difference between the SAM and Panadent is that, "the distance between the upper and lower members of the articulator is greater on the SAM articulator than on the Panadent." This shows a complete misunderstanding by the authors about articulator systems. The height of an articulator has nothing to do with the condylar movement as viewed in this study.

It would take another publication just to correct all the erroneous beliefs the authors revealed in their article. One thing should be clear for every orthodontist: It does not matter which one of today's arcon-type articulators we use as long as we know what we are doing. The thing we orthodontists need least is to switch to another articulator. Stay with whatever you've got!

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Recording condylar movement

I wish to respond to the article by Drs. Hicks and Wood, "Recording condylar movement with two facebow systems." I do not understand how the authors can come to the conclusions stated in this article when the materials and methods used are subject to serious question. The following are but a few.

1. All dental stones have a setting expansion; therefore, it is impossible to make dental casts that are an exact duplicate of the dentition. They are always larger. Kerr Vel Mix has a measured setting expansion of 0.15%. Snow White impression Plaster #2 has a setting expansion of 0.14%. The cumulative value being equal to the sum of the expansion of both casts and cast mountings; the total being 0.58% or 0.58 mm per 100 mm of gypsum. Any measurement or comparison of lower cast movement in the articulator is only relative when compared with the patient. They are not, and cannot be, absolute measured values. A good example is occlusal adjustment in the mouth.

2. Teeth in the mouth are smaller than those produced on the dental cast. Therefore, the centric relation and maximum intercuspation records made as described in this article cannot fit the resultant dental casts the same as the patient. The recorded imprints will be too small. This creates significant unpredictable horizontal and vertical errors.

3. The earpiece mounting pin on the SAM articulator is in a different position than on the Panadent articulator. This is not a factor unless you use a centric relation record as described in Appendix 1. A centric relation record should never be made with 2 mm of clearance between the posterior teeth when mounting casts of the natural dentition regardless of the type of facebow transfer used, including hinge axis type. It is not possible to verify such articulator mountings let alone make comparison measurements. The maximum thickness of centric relation recording material between the closest pair of contacting posterior teeth should be less than 1 mm. Then cast mounting verifications can be made.

4. The differences in the measured values in Table 1 are less than the setting expansion of the dental stones used in the study. Also, I am curious how measurements in the Δx and Δz directions can be measured to 0.01 mm when made with ribbon markings on a mm grid that normally has a 0.2 mm minimum visible width.

5. There is no indication that the lower casts were mounted identically in both systems by verification of occlusal contacts in centric relation.

The CPI and MPI are excellent measurement and diagnostic tools, and they can be used to make exact measurements. However, recorded values are only relative because the objects measured are not precise entities. The Panadent, SAM, and Whip Mix earpiece-type facebows can be used to mount casts on any articulator accepting these types of facebows, and there will be no significant difference when the lower cast is mounted with the appropriate type of centric relation record.

It is suggested that the authors read the excellent monograph written by Alex Bosman, "Hinge axis determination of the mandible."

The authors make some very curious and disturbing statements on page 297, unsupported by any documentation or data in the article, and, in fact, completely irrelevant to the stated purpose of the article. They state that the Panadent System has two key advantages over the SAM. First, the relationship of the upper member of the Panadent does not change with use. What are they referring to? I have used most every articulator on the market, and I have not seen that to be a factor unless the condylar elements wear down because of contact with abrasive materials or the articulator is damaged by being dropped on the condylar housings or lower condylar elements. This would certainly not exclude the Panadent. Second, the Panadent articulator better simulates patient mandibular movement. This statement is absolutely not based on fact and cannot be supported, especially by this article. Harry Lundeen and I did the original research that provided the data which Dr. Lee used to develop the Panadent articulator. For the authors' information, Dr. Lee selected one curved condylar pathway and one curved Bennett Guidance pathway for all five of his articulator Analog Blue Blocks. The 0.5 mm Blue Block has a curved Bennett pathway with side shift but without immediate side shift. However, 1.0, 1.5, 2.0, and 2.5 mm Analog Blue Blocks are nothing more than 0.5 mm Blue Blocks with immediate side shift in addition to the normal side shift. Patients with immediate side shift normally have no identifiable centric relation jaw position for one of several reasons.

The SAM company used the same research data as Dr. Lee used, plus additional confirmatory data from mechanical and electronic axiography to make condylar housing analog pathways for the SAM 2 and 3 articulators. Condylar housing analog pathway #2, coupled with the green Bennett Guidance analog insert, is identical to the 0.5 mm Panadent Blue Block. In addition, SAM has #1 and #3 analog inserts along with additional blue and red curved Bennett Guidance analog inserts. Also, all Bennett Guidance inserts are adjustable to cover a wider range of patients.

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Author's Response

It is unfortunate that neither Dr. Baldauf nor Dr. Wirth enjoyed our article. I believe, however, that it provides useful information to those clinicians using an articulator. In response to their letters, I will try to address what they label "serious flaws" and "incorrect statements."

Dr. Baldauf is certainly correct when he says that the title of the article is wrong—that is if one takes it literally. I really did not expect that readers would do this. My intention was to give the readers the gist of the study in seven words or less, as I was taught. In retrospect, perhaps I should have titled the article, "A comparison of condylar movements on human subjects using an accessory recording device machined to fit the SAM and Panadent articulators when casts are mounted using their respective estimated facebow apparatus, and to determine if the SAM facebow is interchangeable with the Panadent."

Dr. Baldauf stated, "The hinge axis position is only theoretical in nature and has no visible effects on the MPI/CPI measurements." Over the years I have routinely found differences in MPI/CPI values, although minimal, when the same casts were mounted with an estimated facebow and true hinge axis using the same centric record. The difference increases the farther away the estimated hinge is from the true hinge, and the larger the CR/CO discrepancy. This is not theoretical in nature. Anyone actually using a true hinge axis would have observed a difference. This "theoretical" concept has been supported by the article I wrote entitled, "Estimated and true hinge axis: a comparison on condylar displace-

ments." (Wood DP, Korne PH. Angle Orthod 1992;62:167-175.)

Dr. Baldauf expects I would be surprised to find a large difference in MPI/CPI recordings if I took five impressions, five facebows, and five CR recordings and mounted the casts five times. Indeed I would not be surprised because, at the crux of it all, I am a clinician who has mounted every case for over 10 years, and I understand exactly what is being measured.

We are measuring what happens to the condyle from when the teeth make initial contact in CR to maximum intercuspation. The goal in a reproducible technique is to have not only the same point of initial contact but also the same magnitude of openbite or overbite. This will give the same MPI/CPI value. The variable that will yield the most error by far in the system will be the centric relation record. Next would be the facebow, because the arc of closure from CR to MI will be different if not on the true hinge axis. The impressions, pouring and mounting, would have a negligible effect. The only truly reproducible system would be if the subject were deprogrammed from his or her occlusion by wearing a centric relation splint 24 hours a day for 6 months. Then a true hinge axis recording could be performed. Those very few individuals worldwide with the skills to carry out this procedure could take numerous centric bites and true hinge axis recordings and get identical MPI/CPI values.

I am not using the articulator to restore the patient's mouth to 5/10,000 of a inch. My purpose in using the articulator is to find out the extent of the Class II malocclusion and how open the case really is on that day, and to better diagnose the case. It is true that the error in the system that I am using may be 0.1 mm from the patient's true centric. I am willing to accept this because the alternative of hand-held models provides no information about condylar position, and there is no way of achieving this without correct use of an articulator.

Dr. Baldauf states that I have made statements that are not factual, yet he has done exactly that himself. He states that the MPI/CPI does not measure the absolute amount of what the condyles are doing in the patient's joints. I invite him to take the time and make mounted models of dried skulls, as I have done, and he might be enlightened to see that the condyle moves exactly what the MPI/CPI records.

It is disparaging that Dr. Baldauf should suggest that my motives are to market the Panadent system through this journal article. I have no vested interest in this device. I had personally used the SAM 2 system for 5 years before switching to the Panadent system. My graduate students and I found that after 2 years of use and misuse (including dropping the device), few of the SAM 2 articulators split casts checked on the reference columns provided, whereas when we switched to the Panadent system, all of the Panadent articulators did. Numerous colleagues worldwide have also had to return their SAMs for recalibration, because they had gone out of centric. This may not be a problem with the latest version of the SAM, which I am not familiar with. If one is careful, I believe the SAM 2 is an excellent articulator for orthodontic use.

As for the side shift issue, it seems that Dr. Baldauf has not used the SAM axiograph. I have recorded over 300 "healthy orthodontic patients," and I can assure you they all had immediate side shift. The majority had at least 1 mm. The Panadent better simulates condylar movement because the blue condylar block is three dimensionally similar to the human fossa, whereas the yellow SAM 2 condylar block is flat. Should I need to equilibrate an orthodontic patient, I would prefer to use the Panadent.

As for the last two points concerning page 298, Dr. Baldauf is correct. First, I missed a mistake in proofing the article. The ear insert is indeed located more distally, not forward on the SAM facebow. Second, the second reviewer for the original article strongly suggested I add, "the distance between the upper and lower members of the articulator is greater on the SAM than on the Panadent." Of course this should not make any difference.

My purpose in doing research in the area of occlusion was to provide evidence for the basis of having a goal of centric relation for excellence in orthodontics. As an undergraduate student, I had a strong background in occlusion. The use of an articulator is routine in fixed prosthodontics, where the alteration of only a few teeth is involved. As a graduate student, I could not understand how the condylar position could be ignored when making a diagnosis that would result in moving all the teeth around in three planes of space. Oral surgeons know all too well what happens when they fail to seat the condyle at the time of surgery.

As a graduate student I was frustrated by my end results of dual bites, relapse, and excessive wear. When I saw Dr. Roth's finished cases my search to resolve these problems and to provide the same excellent treatment for my patients led me to re-examine the basics of occlusion as Dr.

Roth had done.

It is interesting that many of my published articles have stimulated much criticism and controversy. Our orthodontic past has been replete with controversies of extraction versus nonextraction, surgery versus nonsurgery, functional appliances and now centric relation. The purpose of these studies was not to be controversial but to provide evidence on which treatment can be based. The information derived from these studies has been used in orthodontic diagnosis and treatment of my patients. Although I frequently fall short of centric and my finished cases are yet to look like Dr. Roth's, I am confident I am heading in the right direction.

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E-mail to the editor

As simple as a "click" you said in a recent editorial, and so it is! I would like to share a few thoughts with you, not as formal as a letter to the editor. Perhaps an e-mail to the editor?

First, congratulations for having made Angle again one of the most serious orthodontic journals. But the job just begins, as you have to keep meeting the standard. I am only slightly cautious about the publication of case reports, even though you seem to be very selective by setting up strict guidelines. The real challenge now is to help orthodontics become more scientific by promoting "evidence-based orthodontics." In a recent Moyers Symposium, David Sackett defined the gold standard for orthodontics as the replacement of rhetoric by randomization. As a member of the editorial board or as a referee for journals such as Acta Helvetica and the AJODO every time I review a paper submitted for publication I see the difficulty of really endorsing conclusions of research protocols because of uncertain methodology.

On another note, I believe the use of the Internet could surely be positive for scientific publications. However, the task needs lots of time and energy, which translates to staffing and financial support. We have made a home page on dentoalveolar traumatology (The Angle Orthodontist was the first to write an editorial stressing the importance of orthodontics in that area!) and I see the time needed to keep the material updated. The interaction with other people working in the same field, however, is very rewarding!

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